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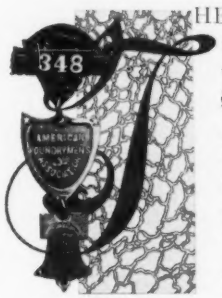
THE FOUNDRY

Vol. 30, No. 5 CLEVELAND, OHIO, JULY, 1907 Whole No. 179

CONVENTION AMERICAN FOUNDRYMEN'S ASSOCIATION

Held at Philadelphia, May 21-24—Report of the Proceedings—Papers and Discussions



THE interest manifested in the annual convention of the American Foundrymen's Association held at Philadelphia, May 21 to 24, reflected the rapid advancement of the foundry trade since the formation of this organization eleven years ago and the attendance, which reached a total of 1,391, was a glowing tribute not only to the birthplace of the association but to those who labored unceasingly for the success of the meeting. The parent body, which now fosters the Associated Foundry Foremen and the Foundry Supply Association, was instrumental in effecting an organization of those affiliated with the brass industry, and although this branch has an enrolment of only 28, the indications are that it will prove one of the most active and largest in point of membership allied with the American Foundrymen's Association.

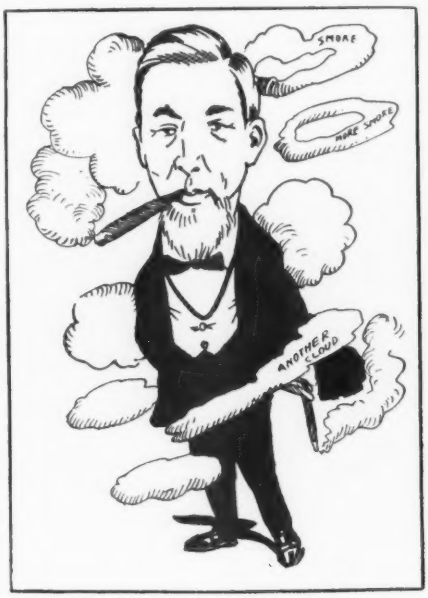
The papers presented, both in number and interest, surpassed those prepared for previous meetings, and covered live topics of interest to all branches of the foundry trade. Owing to the elaborate entertainment program and the lively interest manifested in the displays, the discussions were limited, but it is probable that at future gatherings more time will be allotted the proceedings.

The convention hall proved none too large for the exhibits of foundry supplies and equipment, which overflowed into a tent erected in an adjoining lot. Both the number and the variety of the displays surpassed all previous attempts and as an educational feature proved of paramount interest. Molding machines, sand conveyors and brass furnaces were shown in operation and practical demonstrations were made of the uses of various lines of foundry supplies. This feature attracted a large number of foremen and superintendents, several large concerns having been represented by the heads of all their various departments. Canadian foundrymen were in evidence to the number of more than 100 and practically every state in the union was represented. Other organizations also held meetings during the week, as this event afforded unusual opportunities for gatherings of associations representing the various branches of the foundry industry.

Opening Session.

The assembly hall proved none too large for those who wished to attend the opening session, called to order

Tuesday morning by President W. H. McFadden, of Mackintosh, Hemphill & Co., Pittsburg. Every seat was occupied and many ladies were present. Pleasant words of welcome were spoken by Hon. John E. Reyburn, mayor of Philadelphia, who told how his convention experiences of recent months had amounted to a really liberal education. Thos. Devlin, president of the Philadelphia Foundrymen's Association, welcomed the visitors in behalf of that organization. He incidentally referred to the beginning of the great educational movement in the foundry industry, which led back to Nov. 4, 1891, when the Quaker City local was formed. Dr. Elmer E. Brown, chairman of the Philadelphia entertainment committee, followed Mr. Devlin, and Secretary Moldenke read a message of greeting from President W. H. Bense, of the New England Foundrymen's Association. Responses were made by President W. H. McFadden and President S. T. Johnston, of the Foundry Supply Association. George C. Davis then made an announcement of the trips outlined to the various Philadelphia foundries.



J. S. SEAMAN WAS GRATIFIED WITH THE FINANCIAL SHOWING

Presidential Address.

The address of President W. H. McFadden evoked great enthusiasm. He said that the marked progress of the foundry industry in recent years dates back to the organization of the American Foundrymen's Association in Philadelphia eleven years ago, and also directed attention to the excellent work that is being accomplished by allied organizations. President McFadden spoke as follows:

Gentlemen—I count it an honor to be able to preside at this, the twelfth convention of the American Foundrymen's Association. The eleven years of life of this association coincide with eleven years of progress in the American foundry industry. I cannot properly eulogize this organization for the part it has taken in the wonderful advancement in this important branch of the iron trade. I can say no more than that progress in the American foundry began with the birth of the A. F. A. and that the development of "ye ancient" to our modern foundry has been largely due to the enlightening influences of this association. We have but to think of one of the many lines in which the foundry has advanced; then go back in the proceedings of our association and find that it began with a question or a suggestion of some member at one of our meetings; it was later made the subject of a paper and discussion; then offered to a committee for study and report; and finally given to the foundry industry in our journal.

Foundry Metallurgy.

For example, foundry metallurgy was among the earliest subjects brought before our association for discussion, and our proceedings contain papers which have proved of inestimable value to foundrymen in the development of this branch of foundry practice.

The foundrymen began with experiments on the effects of silicon on iron, its influences were studied and the results were explained at our meetings. Differences of opinion were frequently

manifested, but the knowledge gained proved of great benefit to foundrymen. Experiments and discussions soon brought out the fact that silicon was but one of several elements which exerted a marked influence on cast iron. This led to a study of the effects of other impurities, and has resulted in the development of foundry metallurgy into an exact science.

There is no longer any excuse for the uncertain hit or miss methods formerly used in mixing foundry iron. Our proceedings contain material, which, if intelligently applied, should allow the foundryman to shake off the shackles which bind him to the ruts followed by his forefathers.

DR. RICHARD MOLDENKE AS OUR CARTOONIST FOUND HIM

It is a surprise to me that the opportunities offered by metallurgy are not more universally taken advantage of, as the foundry metallurgist has explained many of the problems formerly thought unsolvable. Where metallurgy is not a success in a foundry, it is due to the lack of knowledge of the one who seeks to apply it rather than to any defect in our present knowledge of the science itself.

Standardized Drillings.

In order to aid the foundry chemist to obtain uniform results, this association developed a series of standardized drillings of cast iron which have become the arbitrator in nearly every laboratory in America. While these drillings are now under the Bureau of Tests of the United States government, their inception and preparation resounds greatly to the credit of our association.

Standard Methods for Analysis.

Hand in hand with the work of standardized drillings has gone the work of standard methods for analysis of iron. Started some years ago, the work has since been in the hands of our metallurgists. After four years of hard and painstaking labor, their committee has at last succeeded in placing before our association a series of standard methods. Their adoption, for use in cases of dispute, will greatly aid in preventing dissension between the buyers and sellers of pig iron. The secretary and committee have worked arduously for the association and deserve great credit for their results.

Standard Methods for Testing Cast Iron.

The work of this association formed the basis for the standard methods for testing cast iron adopted by the American Society for Testing Materials. The data published in connection with this work, in our proceedings, is of itself an encyclopedia on cast iron, giving, as it does, the analysis as well as the strength of a large number of characteristic irons. It is to be regretted that these specifications have not met with more universal usage; it is possible

that they do not fulfill the requirements of founders and, if this is so, steps should be taken to remedy the defects. Cast iron will maintain its position in the future solely by the intelligent application of some method of testing, which will give the engineer an accurate knowledge of its strength in the casting as it makes up a component part of the machine.

Standard Methods of Buying Pig Iron.

The work of the association in bringing about the adoption of standard specifications for buying pig iron deserves mention. The old method of buying by fracture is rapidly disappearing and the modern method of buying by analysis is rapidly taking its place, much to the advantage of both the buyer and the seller. This happy condition of affairs is largely due to the work of this association and the publicity given the matter by its proceedings.

Standard Methods of Foundry Cost Keeping.

We have before us another matter which deserves the careful attention of every foundryman, viz., methods for keeping foundry costs. All foundries have some method, however crude, for ascertaining costs of castings. A careful study of these methods reveal the fact that many of them are not only incomplete, but very misleading. The association should assist in the development of some simple system which will give accurate costs. This should be a foundation, as it were, on which those foundries desiring to go into detail could build and still preserve the principles of the standard method.

Some system is essential to remedy the uneconomical working conditions which exist in our jobbing foundries. Some method should be adopted for properly distributing the general expense or burden of a plant so as to enable the foundryman to ascertain just what class of work was profitable for him to make and what should be left for some other to handle. An intelligent system would lead to a rearrangement in bidding on work which would cause a much improved condition in our jobbing foundries.

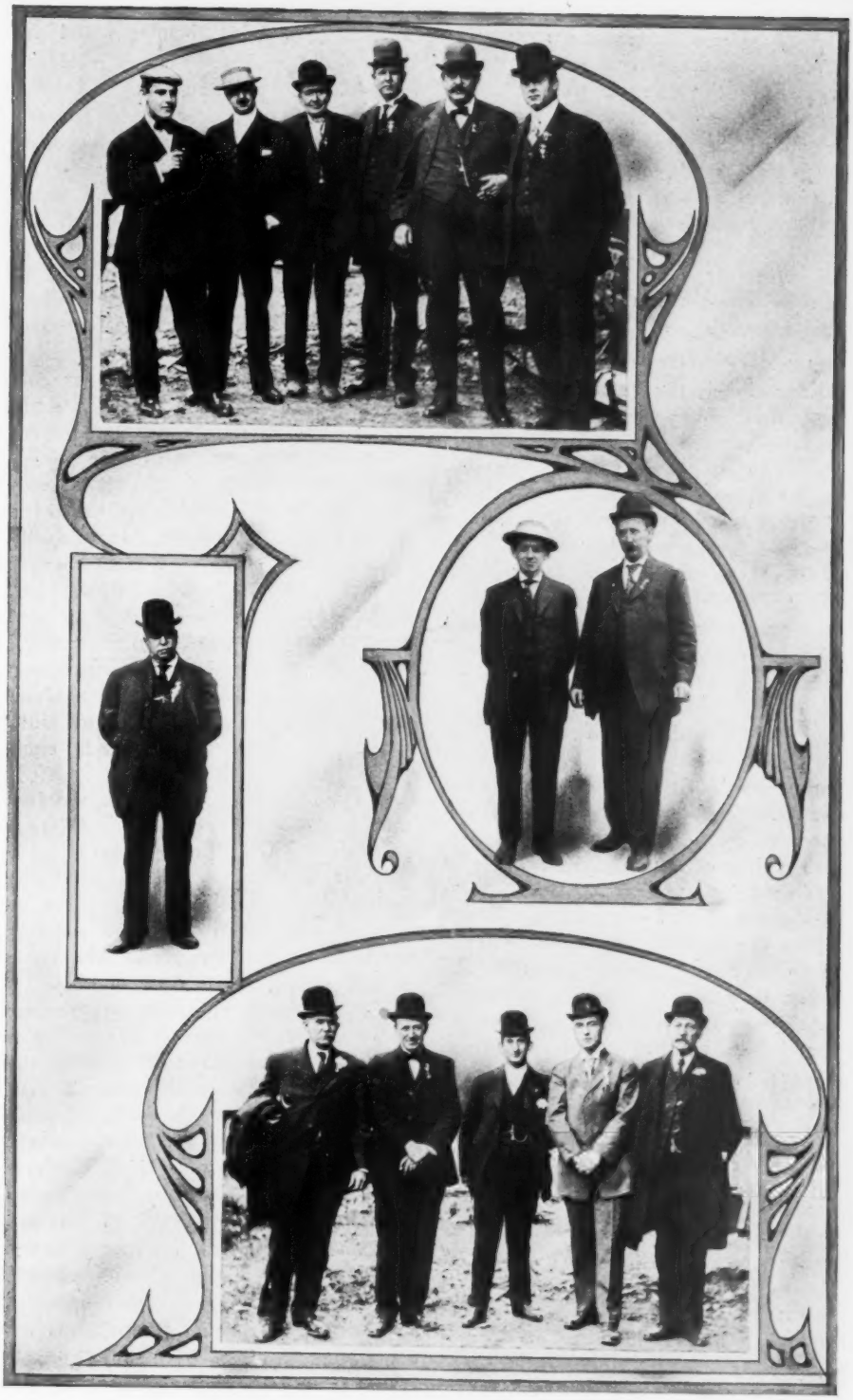
Affiliated Associations.

This address would not be complete without a reference to our Associated Foundry Foremen. Its growth has rivaled our own association, and the results of its formation are very apparent in a desire on the part of the foremen to improve their knowledge of foundry matters. I have read, with much interest, the accounts of the meetings of the different sections, and of the topics which they have for discussion. Such an interchange of ideas along educational lines is a healthy evidence of an advanced state in our foundries. This association is aiding its members to improve foundry conditions by intelligent consideration of those subjects which are of paramount interest to our foundries.

Supply Association.

It is my pleasure to welcome to our midst the new affiliation of our foundry supply fraternity—"we always have them with us"—but this year it is in a brand new guise. Individually, they have been hard to resist, collectively, it behooves the foundrymen to beware. Seriously, the closer association of the foundrymen with those who supply us with materials cannot fail to work for the benefit of both. Too much credit cannot be given to those who have met every demand of advanced conditions in the foundry with improved materials. The exhibition of foundry devices at our convention will prove of value, not only to the seller, but to the buyer. The latter is better able to judge the value of a machine for his own work by watching it operate, than by seeing it in print or in the eye of the sales agent.

This is especially true in regard to the molding machine. Your president would venture the prediction that this most valuable adjunct to our foundry is in its infancy. Conditions are forcing the founder to adopt them whether he will or not, and the exhibition of the most modern types at our convention, where they may be discussed by foundrymen, will do a great deal towards advancing their use.



UPPER GROUP—J. S. SMITH, J. S. MCCORMICK, W. W. SLY, G. F. CRIVEL, HENRY E. PRIDMORE, T. E. MALONE

JUSTUS THORNER GEO. H. WADSWORTH AND SON, WHO HAVE BEEN CONTINUOUS EXHIBITORS AT A. F. A. CONVENTIONS

LOWER GROUP—P. S. BOWEN, J. J. BOWEN, C. H. SCHEERBAUM, J. C. PANGBORN, T. R. COOK

Brass Foundrymen.

We are welcoming the brass foundrymen of the country to our meetings this year, affording them the benefit of our experience, and aiding them to form a brass foundrymen's association. It gives me great pleasure to welcome them to our meetings, and I trust that Philadelphia will prove as good a father to their association as it has to the American Foundrymen's Association.

Foundry Education.

Education is the keynote of our organization; there is a decided interest prevalent at the present time in foundry education. Our organization should therefore be in the forefront of this movement. Many papers upon educational subjects have from time to time been read before this association and different projects have been discussed for establishing foundry schools.

The association has a committee on technical schools which has acted in conjunction with a Pittsburg Foundrymen's Association committee in regard to a foundry course at the Carnegie Technical Schools in Pittsburg.

Five instruction papers have been published by the A. F. A., and more are in process of completion. These papers are elementary and are intended to give general instruction in different branches of foundry practice.

Aside from the above, this association, by its papers, discussions, committees and exhibits, acts as a general educator to the American foundry.

It would, however, seem advisable that this association take a more active part in shaping the educational sentiment so active at present. The question is complex, and it is not my intention to discuss it to any extent in this address. I shall rather point out what has been frequently overlooked, viz., that no one course would cover all the ground referred to by those discussing this question. The classes to be educated are technical men for superintendents, engineers, metallurgists and chemists, and industrial men for foremen, molders, apprentices and handymen.

Three different schools, or courses, would be necessary to advantageously benefit all of these conditions. Our technical schools should so equip themselves as to properly teach the first class mentioned. It is obvious that they are not at present fitted to do so. It is the duty of the members of this association, both as an association and as individuals, to exert their influence in such a manner that technical schools will give more intelligent attention to this important branch of industry. In order to accomplish anything of value, the technical institutes should be urged to provide instruction by scientifically educated men who have had practical foundry experience. Courses and equipment should be supplied to give a practical as well as a theoretical foundry training; such instruction should develop men who, in a short time, would be able to work into foundry superintendents and engineers.

The education of foremen, molders and apprentices presents a different problem. In localities where trade schools with night courses exist the problem is simplified. The value to the student then depends entirely upon the instruction given. The trade school should teach such branches as would aid the foreman to become more proficient, the molder to be a better molder and fit to assume the position of a foreman, and the apprentice to master his trade. Localities favored with trade schools where foundry practice and allied subjects were intelligently taught, would soon become the supply depot of foremen and superintendents for the country.

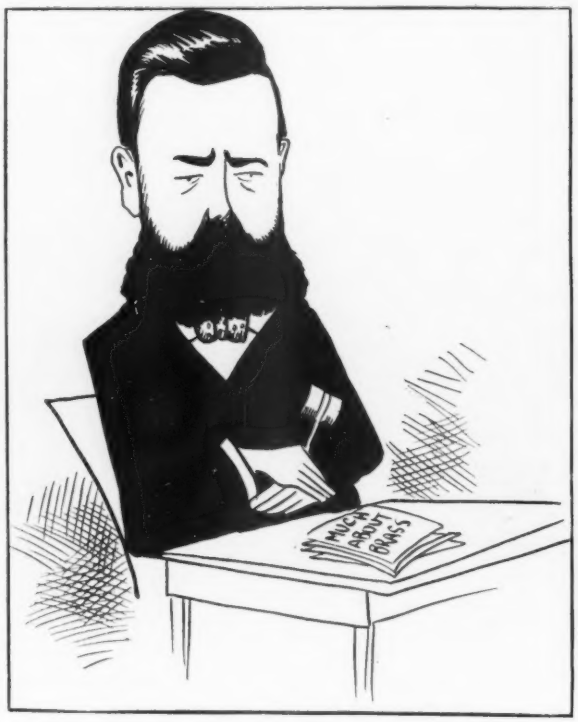
The third school should educate handymen and make them proficient with their hands and brains, thus enabling those who have been unable to learn a trade to improve their condition. Such schools are, however, being maintained by other organizations and do not come entirely un-

CANADIAN DELEGATION AT THE PHILADELPHIA CONVENTION

der the scope of this association. The subject is, however, a vital one to foundrymen and the scarcity of competent molders, together with the disposition in some quarters to restrict the number of apprentices make it one which may well be borne in mind.

Fluxes and Alloys.

A paper recently read before the Pittsburg branch of our association called attention to fluxes and alloys in a very interesting manner. Our foundries are, from time to time flooded with all kinds of quacks for the improvement of cast iron. It is not possible for the foundryman to separate the "chaff from the wheat," and consequently all are generally classed as "bad" for lack of proper facilities for determining their efficiency. It would seem to be within the province of this association to have these materials investigated for the benefit of our members.



C. J. CALEY PRESIDED OVER THE DELIBERATIONS OF THE BRASS SECTION

Permanent A. F. A. Testing Department.

Our association needs a permanent department for investigating the problems which are continually arising in connection with our industry. If this department could be installed in connection with one of our technical schools, it would be of great value to our association. Unsolved problems in regard to iron could be investigated in an impartial manner. Sands, fluxes, alloys, core compounds and blackings could be studied and tested much to the benefit of the manufacturer and the consumer. Our foundrymen, from an economical standpoint, could well afford to maintain such a department, for it would soon be shown that many of the materials used in our foundries are carrying much more than a legitimate profit. The American Foundrymen's Association stands for progress along educational lines. Under the guidance of our worthy secretary it has achieved a reputation in America, in England, and on the continents as a strong and progressive organization. We, as members, certainly owe it to the association to maintain this position attained by painstaking effort.

Soon after becoming president, I ascertained the fact that the work of the association was hampered by lack of funds. The income was entirely dependent upon the dues of the members; an increased membership meant an increased constant revenue. I have consequently devoted my term to securing new members for the association, and about 150 have joined this year. This does not, however, make

the income of the association sufficient to increase the scope of its work.

At the New York meeting the dues were reduced from $10.00 to $5.00 per year, with the idea that the membership would be more than proportionally increased. This was not the case, however, and, after consulting with many members, your retiring president advises that the dues be again increased to $10.00, so that the association may accumulate a fund which will make possible a permanent testing bureau.

Journal of the A. F. A.

In answer to some two thousand letters sent out this year in the interest of our association, I have had many inquiries as to our journal which has been formerly published in various forms. A journal would be of great benefit to the members of the American Foundrymen's Association, but to publish one with our present income would be out of the question. If the dues were changed back to $10.00, with our increased membership we should have no trouble in issuing a journal which would prove of great value. It is very easy to assent to the request of your president, vote for a journal, and then go home and think no more about it until next year. Our secretary would need the support of every member were he again to publish a regular organ. The entire life of this association should not be bound up in one annual meeting. The members should be kept in touch with one another by a progressive journal. There is more interest in our work than ever before and the time is ripe for a movement which will bring a majority of the foundrymen of the country into the ranks of this association. This can only be accomplished by the united efforts of all our members.

DR. E. E. BROWN WAS POPULAR

In closing, I desire to publicly express my thanks to our honored secretary, Dr. Moldenke, for his proficient and untiring efforts in behalf of this organization, and for his unfailing courteous assistance to me during my term as president.

I wish to thank many of you for kind words of encouragement, and to urge you to be loyal to your next president in deeds as well as words. Should he ask you to obtain one new member, do not again ignore the association which has done so much for your chosen industry.

My congratulations to the Philadelphia foundrymen, to the Foundry Supply Association, and to our secretary, for the able way in which they have handled the arrangements for this twelfth gathering.

I wish personally to express the obligation of this association to those who have so faithfully labored in the production of papers for these meetings.

Our conventions happily combine three important phases of foundry

work—the educational, as illustrated in our papers; the mechanical, as demonstrated by our exhibits; and the social, as dispensed by our hosts. Let us, for a few days, forget the cares of the foundry and freely partake of the educational and social feast which is so abundantly set before us.

Fellow members, prosperity has brought increased responsibilities in the form of vexing problems which are before many of us for settlement. Your retiring president wishes you all a continuation of this prosperity, and he looks forward to a future in which the enlightening influences of this association shall have permeated the foundry industry and so broadened the employer and the employe that they may meet without strife on the common ground of mutual helpfulness.

Report of the Secretary-Treasurer.

The report of Dr. Richard Moldenke, secretary-treasurer of the American Foundrymen's Association, was most gratifying, as it showed a big increase in membership and a balance in the treasury larger than at any time in the history of the organization. The report follows:

It is with great pleasure that I am able to report great progress for the year just passed. Thanks to the well directed efforts of our president, Mr. McFadden, the membership of our association has grown fully 75 per cent, which in itself is a remarkable fact considering the conservatism of the trade and the difficulty of getting men who compete with each other together. Our vice presidents have also assisted your secretary materially in bringing up the membership, so that today we are 532 strong. There have been but few resignations during the year, and no one was dropped for non-payment of dues. Our hearty thanks are due to our good officers, who have given their time and means in furthering the good work to the lasting benefit of the foundry industry.

The financial condition of the association is also an excellent one:

Income from dues, sales, etc.....	$2,847.45
Expense for the transactions.....	303.41
Salaries	1,200.00
Printing	198.35
Postage	383.00
Sundry	8.75
Balance	$ 753.94

No traveling expense has been charged to the association, but while the balance looks large, most of it is on account of dues paid in advance for the coming year by the new members just received. The result is, nevertheless, highly gratifying, and argues well for the future of our work.

The year has been a remarkable one. Everybody has been busy, and probably little time has been given to experimenting and research. Nevertheless, your secretary's office has been a bureau of information of very widespread influence, and has doubtless saved many dollars for the foundrymen who have taken advantage of its existence. Hardly a week passes but that several inquiries come in from people desirous of embarking in the business of making castings of all kinds and descriptions. It is a case of "don't" most of the time, which advice, if followed, saves many heartaches for those who would suffer from misdirected competition. No one can complain of legitimate competition when based on a thorough understanding of costs, but a plunge on the part of one unacquainted with the pitfalls of making castings often leaves a trail of ruin in the territory which he affects.

The wonderful success of the exhibition of foundry machines and appliances shown at Cleveland, has stimulated everybody to such an extent that I know parties here now who come specifically for the purpose of purchasing their equipment, after studying the various types offered. Perhaps in no industry are mechanical appliances wanted more badly than in the foundry, and with the enterprise shown by our supply men in placing their best and all before us at one place and time, I venture to predict that this feature of our con-

TABOR DISCUSSES MOULDING MACHINES

HOWARD EVANS PREPARES FOR THE SHAD DINNER

BAUMGARDNER DISCUSSING THE TARIFF

WOODISON IN THE CLAM BELT

ventions will do more lasting good for the trade than anything else we can offer. Seeing is believing to most of our conservative foundrymen, and here they have what they cannot get away from, considering that their competitors also have eyes to see and brains to calculate prospective profits.

I would continue to urge foundrymen to join the association. The complaint is heard everywhere that there are too many associations to belong to. This is true in a sense. So far as we are concerned, let the foundrymen take out a membership and delegate their foundry superintendents, foremen, pattern foremen, metallurgists and chief accountants to keep track of the work done, and call it not an expense, but an investment. You will hardly realize how deep our work has sunken into the minds of those who are up against foundry problems. I have at home stacks of letters from foundry foremen asking all kinds of information, begging for it under stress of difficulties they are put into by the purchase of irons unsuited for their work. They write, "Our firm is not a member of your association, in fact does not want to go to the expense—but please let me know how I can use iron which analyses so and so for this work. I have paid for the analysis out of my own pocket to see why I cannot get results which my firm says I should," etc.

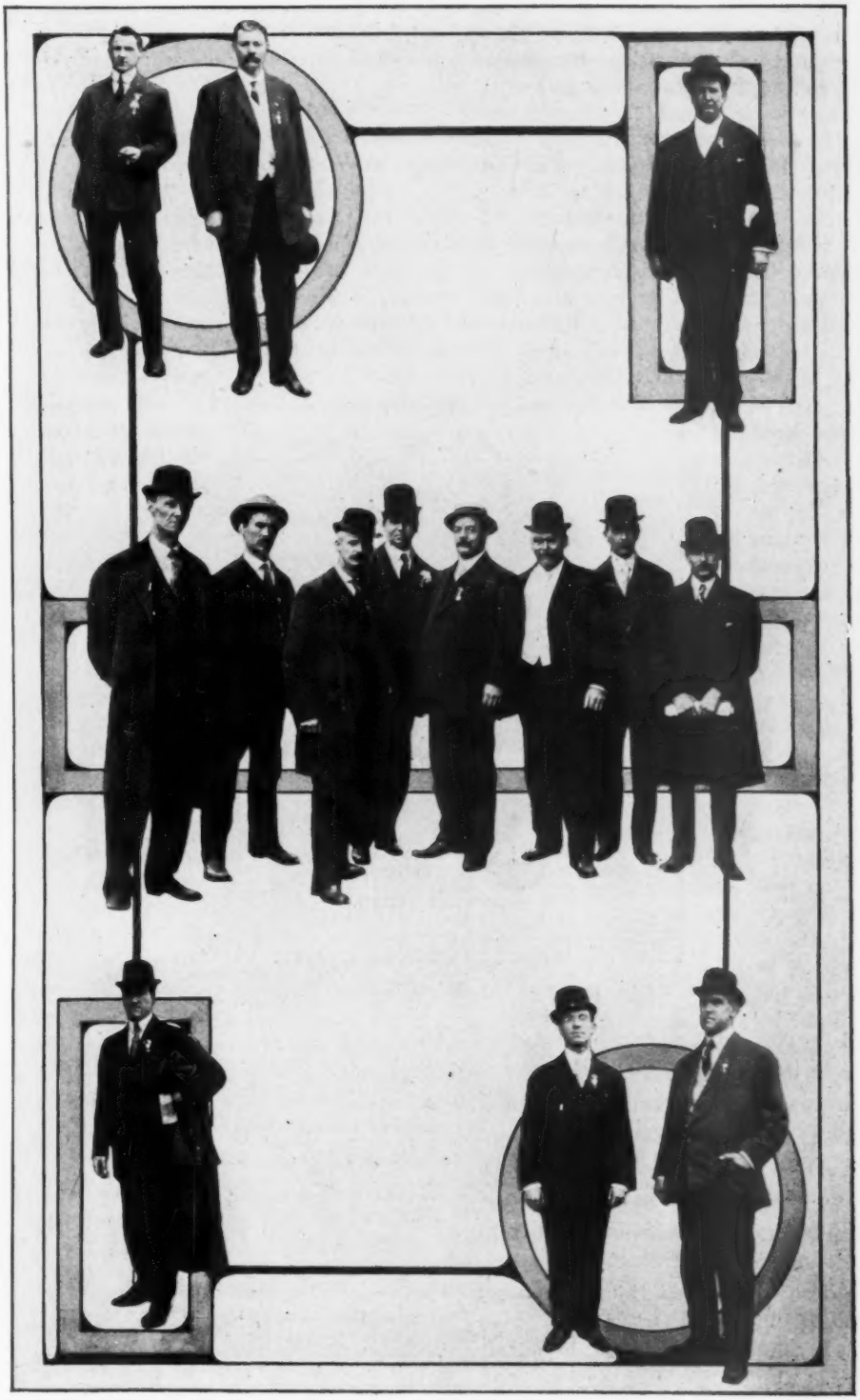
Others have troubles which can be traced to bad coke or bad cupola practice, but all want to know, and learn the principles of their business thoroughly. This refers especially to the operatives of the shop. The owners also write me hundreds of letters, but they want financial information, costs, estimates, etc. Your secretary makes it a rule to answer everyone as fully as possible. He is inclined to draw the line on non-members when the correspondence gets over five-page letters, but can truthfully state that no foundry foreman has ever proved ungrateful for advice and help given from our office, while this cannot always be said of their employers. We're therefore thankful to our Philadelphia hosts that they have drawn the line on the entertainment of their guests to include only members of the various associations invited. This rule will be kept up in the future.

I would, again, emphasize the fact that very few foundrymen realize that their employes are highly anxious to learn all they can, and no better opportunity can be given them to see and hear, compare notes, and benefit their employers, than to take out a membership in the association, and send the best men to the conventions.

Among the matters of interest to us that have occurred during the year are the following: There has been formed an association for the promotion of industrial education, which promises to do much toward the solution of that vexed but all important problem of where we are to get our supply of trained mechanics in the future. Our vice president, Stanley G. Flagg Jr., represented us at the dedication of the Engineering building of the University of Pennsylvania, and your secretary did the same for the United Engineering building in New York, the gift of Mr. Carnegie. The government tests on coke for foundry purposes were continued, and congress has appropriated further funds, some of which are to be used for the study of the cupola. I would respectfully ask this association to authorize a committee from its membership to aid in this work with their advice and co-operation.

We have to again thank the publishers of THE FOUNDRY for their kindness in saving us very much money in the publication of our transactions. We sincerely hope that this may be amply repaid them by our members in other ways.

There will be formed an association of brass founders and allied interests at this convention, if those who come for this purpose so decide. We wish this movement every success, and if



W. D. MERRIAM, S. F. SMYTH, JOHN HILL
P. C. SMITH AND PARTY
W. L. LAIB J. I. FASIG, E. C. LINDSAY

it can chronicle as much good to the brass industry as we feel we have done for our foundries, the nation will indeed have been the gainer.

The better financial situation will enable us to continue the publication of our instruction papers. The one recently issued brought such a flood of letters and orders for the preceding numbers, that I feel justified in recommending the broadening out of this work as much as possible. Our Mr. Field, who looks after the metallurgical part of this work, and our Mr. West, for the molding, have consented to continue the good work. We hope further to do something for the patternmaker, coremaker, etc., so that a firm by placing these short easily read papers into the hands of their intelligent young men, a direct improvement will result. The foreman, of course, will be the man to go over the information with the men, and we know that our modern foremen are only too glad to help in this work.

HOWARD EVANS AT WASHINGTON PARK

In conclusion I want to thank our officers and membership for the unfailing courtesy with which they have assisted me in the somewhat arduous task of trying to hold the dignity and work of our association up to the level demanded by the times. Nothing should please us more than to see information spread broadcast so that the nation may benefit, and its resources be utilized to the best advantage. Let us continue the good work with renewed vigor and strive to lift the foundry industry still higher than it already is.

Standard Methods for the Analysis of Iron.

In the absence of H. E. Diller, chairman of the committee on standard methods for the analysis of iron, the report on methods for determining the graphitic carbon, manganese and phosphorus was presented by Dr. Richard Moldenke. The committee's report is given in full below:

At the annual convention of the Association in 1905, this committee reported a method for the determination of silicon in iron, and last year added methods for determining total carbon and sulphur. The committee now adds methods for determining graphitic carbon, manganese and phosphorus, thus including all the determinations usually made on iron in which occasion for difference between the buyer and seller is apt to arise. This report will therefore include all the methods decided upon.

We would also like to call attention to the following quotation from the report of 1905, which indicates the intentions of these methods.

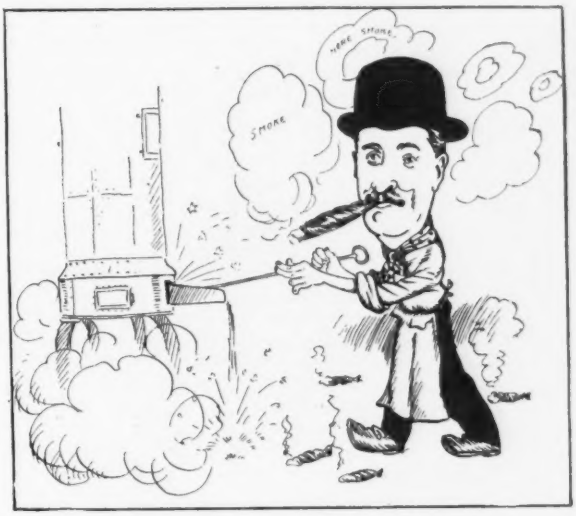
"In recommending the above method, it was recognized that it is almost an impossibility to get chemists to use a standard method in their daily work. Hence the above method, as recommended, is intended primarily as a check method in case of dispute between laboratories, or as between buyer and seller.

"Hence a method, accurate in every

point was sought, shortness being sacrificed to some extent to insure accuracy or the chance of error by a careless operator. Little in the above is left to the judgment of the chemist.

"It will be further recognized that in the purchase and sale of pig iron or castings under specification, that standard methods are essential in order to allow the parties of both parts to make their determinations with the assurance that, on the score of method, they are on the same footing."

We wish also to emphasize the ideas involved in the selection of members of this committee—that is to have representatives from commercial laboratories as well as works chemists, and to have members from different sections of the country. The success in carrying out these ideas will be seen by the following list of members:



S. T. JOHNSTON TAPPING THE CUPOLA

Andrew A. Blair, Booth, Garrett & Blair, Philadelphia.

H. E. Diller, chemist, Western Electric Co., Chicago.

H. E. Field, metallurgical engineer, Mackintosh, Hemphill & Co., Pittsburg.

R. F. Flinterman, chief chemist, McCormick division, International Harvester Co., Chicago

Allan P. Ford, metallurgist, Eaton, Cole & Burnham Co., Bridgeport, Conn.

J. O. Handy, chief chemist, Pittsburg Testing Laboratory, Pittsburg.

J. R. Harris, chief chemist, Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

H. C. Loudenbeck, chief chemist, Westinghouse Air Brake Co., Pittsburg.

R. S. MacPherran, chief chemist, Allis-Chalmers Co., Milwaukee.

W. G. Scott, chief chemist, J. I. Case Threshing Machine Co., Racine, Wis.

Henry Souther, Henry Souther Engineering Co., Hartford, Conn.

Prof. Thomas B. Stillman, Stevens Institute of Technology, Hoboken, N. J.

Determination of Silicon.

"Weigh one gramme of sample, add 30 c. c. nitric acid (1.13 sp. gr.); then 5 c. c. sulphuric acid (conc). Evaporate on hot plate until all fumes are driven off. Take up in water and boil until all ferrous sulphate is dissolved. Filter on an ashless filter, with or without suction pump, using a cone. Wash once with hot water, once with hydrochloric acid, and three or four times with hot water. Ignite, weigh, and evaporate with a few drops of sulphuric acid and 4 or 5 c. c. of hydrofluoric acid. Ignite slowly and weigh. Multiply the difference in weight by .4702, which equals the per cent of silicon."

Determination of Sulphur.

Dissolve slowly a three gram sample of drillings in concentrated nitric acid in a platinum dish covered with an inverted watch glass. After the iron is completely dissolved, add two grams of potassium nitrate, evaporate to dryness and ignite over an alcohol lamp at red heat. Add 50 c. c. of a one per cent solution of sodium carbonate, boil for a few minutes, filter, using a little paper pulp in the filter if desired, and wash with a hot one per cent sodium carbonate solution. Acidify the filtrate with hydrochloric acid, evaporate to dryness, take up with fifty c. c. of water and two c. c. of concentrated hydrochloric acid, filter, wash and after diluting the filtrate to about 100 c. c. boil and precipitate with barium chloride. Filter, wash well with hot water, ignite and weigh as

barium sulphate, which contains 13.733 per cent of sulphur.

Determination of Phosphorus.

Dissolve two grams sample in fifty c. c. nitric acid (sp. gr. 1.13), add 10 c. c. hydrochloric acid and evaporate to dryness. In case the sample contains a fairly high percentage of phosphorus it is better to use half the above quantities. Bake until free from acid, redissolving in twenty-five to thirty c. c. of concentrated hydrochloric acid, dilute to about sixty c. c., filter and wash. Evaporate to about twenty-five c. c., add twenty c. c. concentrated nitric acid, evaporate until a film begins to form, add thirty c. c. of nitric acid (sp. gr. 1.20) and again evaporate until a film begins to form. Dilute to about 150 c. c. with hot water and allow it to cool. When the solution is between 70 degrees and 80 degrees C. add fifty c. c. of molybdate solution. Agitate the solution a few minutes, then filter on a tarred Gulch crucible having a paper disc at the bottom. Wash three times with a three per cent nitrate acid solution and twice with alcohol. Dry at 100 degrees to 105 degrees C. to constant weight. The weight multiplied by 0.0163 equals the per cent of phosphorus in a one gram sample.

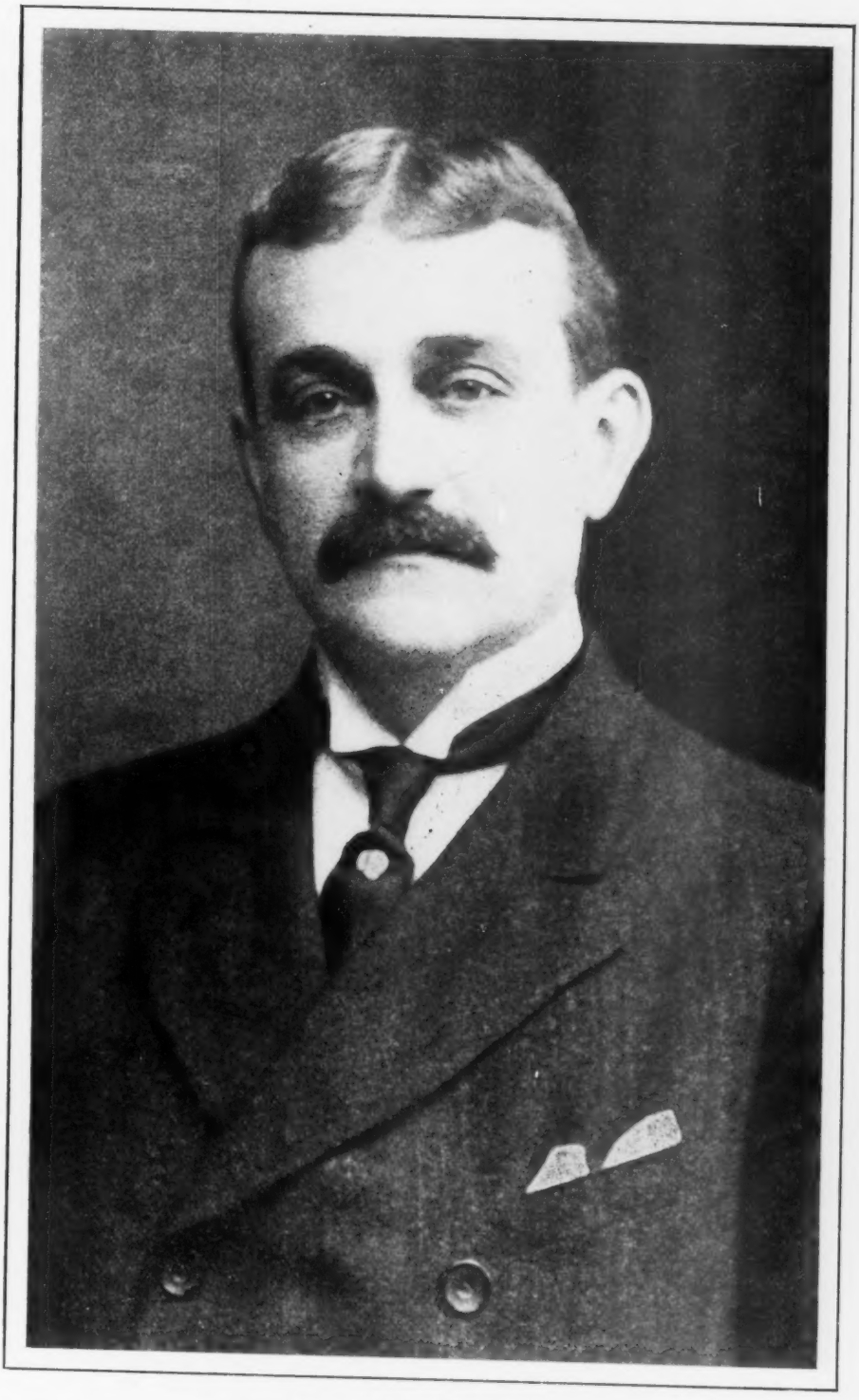
To make the molybdate solution add one hundred grams molybdate acid to 250 c. c. water, and to this add 150 c. c. ammonia, then stir until all is dissolved and add 65 c. c. nitric acid (1.42 sp. gr.). Make another solution by adding 400 c. c. concentrated nitric acid to 1100 c. c. water, and when the solutions are cool, pour the first slowly into the second with constant stirring and add a couple of drops of ammonium phosphate.

Determination of Manganese.

Dissolve one and one-tenth grams of drillings in twenty-five c. c. nitric acid (1.13 sp. gr.), filter into an Erlenmeyer flask and wash with thirty c. c. of the same acid. Then cool and add about one-half gram of bismuthate until a permanent pink color forms. Heat until the color has disappeared, with or

STANLEY G. FLAGG JR.

STANLEY G. FLAGG JR., of Philadelphia, who was elected president of the American Foundrymen's Association, bears a name that has long been recognized in the foundry trade of this country. He is the active spirit of the firm of Stanley G. Flagg & Co., composed of himself and his father, who, though still in excellent health at the age of 77, has largely turned over the control of the extensive interests of the firm to his son. It is nearly half a century since the elder Flagg discovered a method by which all gas, steam and water pipe fittings, which had previously been made of brass, could be made of malleable iron at a great saving in the cost of their manufacture. The firm's business along this line grew rapidly and at the present time it operates two large establishments, one in Philadelphia, where the main office is located, and the other in Pottstown, Pa., where the principal manufacturing is done. Stanley G. Flagg Jr. was brought up to a thorough knowledge of the trade under the direction of his father, and many years ago was admitted to membership in the firm whose development has been largely due to his energy and aggressiveness. He is a practical and thorough foundryman, conversant not only with the methods of American practice, but European as well. There are few foundries in the United States better known than that of Stanley G. Flagg & Co. in its special lines of small steel castings, malleable and gray iron castings, especially such as fittings for gas, steam and water pipe connections. Mr. Flagg was active in promoting the recent meeting of the American Foundrymen's Association in Philadelphia, and as chairman of the ways and means committee of the Philadelphia association, did a large part of the work in securing the necessary funds to assure the success of the convention. He also took an active part in the formation of the American Foundrymen's Association and has been one of the most ardent supporters of this organization ever since. Of patriotic ancestry, he is a member of the Sons of the Revolution, and Society of Colonial Wars, and of the Union League and Art clubs of Philadelphia.



STANLEY G. FLAGG JR.
President of the American Foundrymen's Association

without the precipitation of manganese dioxide, and then add either sulphurous acid or a solution of ferrous sulphate until the solution is clear. Heat until all nitrous oxide fumes have been driven off, cool to about 15 degrees C.; add an excess of sodium bismuthate — about one gram — and agitate for two or three minutes. Add fifty c. c. water containing thirty c. c. nitric acid to the liter, filter on an asbestos filter into an Erlenmeyer flask, and wash with fifty to one hundred c. c. of the nitric acid solution. Run in an excess of ferrous sulphate and titrate back with potassium permanganate solution of equal strength. Each c. c. of N-10 ferrous sulphate used is equal to 0.10 per cent of manganese.

Determination of Total Carbon.

This determination requires considerable apparatus; so in view of putting as many obstacles out of the way of its general adoption in cases of dispute your committee has left optional several points which were felt to bring no chance of error into the method.

The train shall consist of a pre-heating furnace, containing copper oxide (Option No. 1) followed by caustic potash (1.20 sp. gr.), then calcium chloride, following which shall be the combustion furnace in which either a porcelain or platinum tube may be used (Option No. 2). The tube shall contain four or five inches of copper oxide between plugs of platinum gauze, the plug to the rear of the tube to be at about the point where the tube extends from the furnace. A roll of silver foil about two inches long shall be placed in the tube after the last plug of platinum gauze. The train after the combustion tube shall be anhydrous cupric sulphate, anhydrous cuprous chloride, calcium chloride, and the absorption bulb of potassium hydrate (sp. gr. 1.27) with prolong filled with calcium chloride. A calcium chloride tube attached to the aspirator bottle shall be connected to the prolong.

In this method a single potash bulb shall be used. A second bulb as sometimes used for a counterpoise being more liable to introduce error than correct error in weight of the bulb in use, due to change of temperature or moisture in the atmosphere.

The operation shall be as follows: To one gram of well mixed drillings add 100 c. c. of potassium copper chloride solution and 7.5 c. c. of hydrochloric acid (conc.). As soon as dissolved as shown by the disappearance of all copper, filter on previously washed and ignited asbestos. Wash thoroughly the beaker in which the solution was made with 20 c. c. of dilute hydrochloric acid (1.1), pour this on the filter and wash the carbon out of the beaker by means of a wash bottle containing dilute hydrochloric acid (1.1) and then wash with warm water until all the acid is washed out of the filter. Dry the carbon at a temperature between 95 and 100 degrees C.

Before using the apparatus a blank shall be run and if the bulb does not gain in weight more than 0.5 milligram, put the dried filler into the ignition tube and heat the preheating furnace and the part of the combustion furnace containing the copper oxide. After this is heated start the aspiration of oxygen or air at the rate of three bubbles per second, to show in the potash bulb. Continue slowly heating the combustion tube by turning on two burners at a time, and continue the combustion for thirty minutes if air is used; twenty minutes if oxygen is used. (The Shimer crucible is to be heated with a blast lamp for the same length of time.)

When the ignition is finished turn off the gas supply gradually so as to allow the combustion tube to cool off slowly and then shut off the oxygen supply and aspirate with air for ten minutes. Detach the potash bulb and prolong, close the ends with rubber caps and allow it to stand for five minutes, then weigh. The increase in weight multiplied by 0.27273 equals the percentage of carbon.

The potassium copper chloride shall be made by dissolving one pound of

Courtesy the Philadelphia Inquirer

THE LADIES WHO ATTENDED THE A. F. A. CONVENTION

the salt in one liter of water and filtering through an asbestos filter.

Option No. 1.—While a pre-heater is greatly to be desired, as only a small percentage of laboratories at present use them, it was decided not to make the use of one essential to this method; subtraction of the weight of the blank to a great extent eliminating any error which might arise from not using a pre-heater.

Option No. 2.—The Shimer and similar crucibles are largely used as combustion furnaces and for this reason it was decided to make optional the use of either the tube furnace or one of the standard crucibles. In case the crucible is used it shall be followed by a copper tube 3-16 inch inside diameter and ten inches long, with its ends cooled by water jackets. In the center of the tube shall be placed a disk of platinum gauze, and for three or four inches in the side towards the crucible shall be silver foil and for the same distance on the other side shall be copper oxide. The ends shall be plugged with glass wool, and the tube heated with a fish tail burner before the aspiration of air is started.

Graphite.

Dissolve one gram sample in thirty-five c. c. nitric acid (1.13 sp. gr.) filter on asbestos, wash with hot water, then with potassium hydrate (1.1 sp. gr.) and finally with hot water. The graphite is then ignited as specified in the determination of total carbon.

H. E. DILLER, Secretary

Report of the Committee on Costs.

Kenneth Falconer, chairman of the committee on costs, made a progress report, and on notice of H. E. Field, Pittsburg, the committee was continued and was authorized to expend a reasonable sum in collecting and codifying data on cost systems and presenting the information for the benefit of the association. Mr. Falconer said:

At the last convention of this association a committee was appointed to study the question of "Uniform Methods of Cost Finding" applicable to

the foundry business, and to report at this convention.

The three questions naturally relating to this matter, and to be considered by your committee are:

First—Is it desirable that individuals, firms and corporations engaged in the manufacture and sale of castings should figure their costs and make up their estimates for selling purposes on similar lines?

Second—Do the members of this association figure their costs and make up their estimates for selling purposes on similar lines, or are their costs and estimates figured on a different basis?

Third—Is it possible for this association to secure a standard definition of costs and standard methods of figuring costs, and making estimates for selling purposes?

As to whether uniformity in methods of cost finding is desirable, the mere appointment of your committee is sufficient answer. We have, however, the precedent of other associations, such as the Steel Founders' Society, the Jobbing Founders' Association, the Stove Founders' Association, and the Malleable Iron Founders' Association, who have all at one time or another given attention to the question of uniform methods of cost finding and taken action thereon.

Series of Questions.

Since the last convention, your committee prepared a series of questions which were sent to the members of this association, and which related to the methods of cost finding and of estimating. The replies to these questions have been carefully studied and tabulated. They demonstrate very clearly that, in the business in which we are all interested, that is, the manufacture and sale of castings, there is no uniformity whatever regarding the figuring of costs for record, and making of estimates for selling purposes. To take the one point of distribution of overhead expenses, one reply received stated that the writer had an elaborate system by which he was able to distribute each item of general expense accurately and properly on each casting manufactured. A reply received from another member of the association stated that overhead expenses were distributed "any old way, and I wish I didn't have a foundry." It goes without saying, that if these two members of our association were in competition for local business, such competition would not be the intelligent competition which makes for the life of trade, but would rather be the unintelligent competition which is destructive to both competitors. Competition by a manufacturer who knows his costs is a much easier competition to meet than competition of a competitor based either on guess work as to costs, or a more or less inaccurate knowledge as to market prices.

Ways of Securing Cost Methods.

If it is the feeling of this association that it is desirable to adopt standard methods of figuring costs and of making estimates for selling purposes, there are three ways by which these results may be secured:

First—By following the plan usually adopted, where a number of industrial organizations have been merged or combined, that is, by appointing a committee on costs to visit the different plants represented, examine conditions, and advise with those in control. This plan is, however, impracticable in the case of an association such as this, the plants concerned being so widely scattered, and the conditions under which they operate so different.

Second—A committee might be appointed to study the question currently, and report from time to time, obtaining the views of members of the association regarding the various points connected with cost finding and estimating. While this would possibly be a better way in the case of a local association meeting frequently, it would not work in the case of a national association, such as ours, meeting at such long intervals.

The third alternative is for the association to obtain the services of

a specialist to outline a practical cost system, embodying in itself the general principles applicable to the foundry business, the details being purely suggestive, and subject to change and modification when applied to the plant or establishment of any member of the American Foundrymen's Association.

The last plan mentioned would appear to your committee to be the most feasible, but unfortunately, the association is not in a position to take up the matter on a scale involving any considerable expenditure of money. Moreover, the question of cost finding is of much greater importance to some of our members than to others. To some foundrymen, a proper cost system is a matter of commercial life or death, while to others it is simply a convenience, as for instance, in the case of machinery concerns, whose foundry product does not enter into the market as such, but as a portion of a finished machine, sold as a machine, and not as castings.

In consequence of these conditions, your committee has considered the matter with a view to devising, if possible, some means by which the expenditure, while limited in amount, would not entail any outlay on the part of those members of the association not interested in the matter.

Your committee believes this can be accomplished, and suggests that either the present committee on costs be continued, or a new committee appointed, authorized to receive subscriptions for a limited amount from those interested; the money so raised to be expended for the services of specialists to prepare a report, and for the cost of placing it in the hands of subscribers, in printed form.

Cost System.

Without entering into a multiplicity of details, your committee has very clearly in mind just how far it would be well to go. We would not recommend or approve of securing for this association any elaborate detailed scheme, but we have in mind simply the presentation of the basic rules of foundry cost finding, and an outline of simple methods which, if followed by the different members of this association, would result in establishing a uniform basis on which to figure costs and estimates. In other words, your committee strongly recommends that the American Foundrymen's Association should put itself on record to endorse the establishment of a common and standard definition for the use of members of the association when speaking of costs, when figuring costs, and when making estimates for selling purposes.

The answers to the questions sent out by your committee very clearly indicate that items regarded by one foundryman as overhead expense, or general indirect cost, are entirely different from those so regarded by other foundrymen. The replies show that the rate for overhead expenses amongst the 23 per cent of members who calculated these expenses on labor ranges from 2 per cent to 200 per cent.

For purposes of discussion, it makes no difference whatever whether the expense rate calculated on the labor cost is high or low, for the cost of the foundry's product may be high or low as a result of many different factors. It is, however, of very great significance if the rate on labor be high or low on account of including or omitting to include items of indirect cost, which one foundry may regard as included in his overhead expenses, while another foundryman does not regard them as part of the cost of his product.

The remainder of the session was devoted to papers on "Sound Castings," by David Spence, Franklin, Mass, and "Manganese in Cast Iron," by H. E. Field, Pittsburg, Paul Kreutzpointner, of Altoona, Pa., spoke briefly on "The Supply of Skilled Labor in the United States," and J. S. Seaman, for the auditing committee, reported that the treasurer's accounts were correct, and for the first time in the history of the organiza

A FEW OF THE CONVENTION SOUVENIRS

tion a fair balance remained in the treasury.

Afternoon Session.

At the afternoon session Henry B. Cutter, Seneca Falls, N. Y., presented a paper on "Cast Thread Fittings," in which he referred to the success that has been achieved in casting threads on various kinds of fittings. "The Evolution of the Foundry Business," was the topic of a paper read by Edw. B. Gilmour, Elizabethtown, Pa. He described the gravity molding machines made by the Mitchell-Parks Mfg. Co., St. Louis. Thos. D. West, Sharpsville, Pa., discussed the gray iron foundry as a business venture and pointed out many disadvantages of this line of manufacture not apparent to those not fully conversant with foundry practice. Dr. Richard Moldenke, Watchung, N. J., likewise directed attention to the advantages and the disadvantages of the malleable foundry as a business venture and suggested that no one should undertake to start a malleable foundry without an assured daily output of from 3¼ to 5 tons. "Small Points in the Core Room which are not Considered," was the subject of a paper read by H. M. Lane, Cleveland.

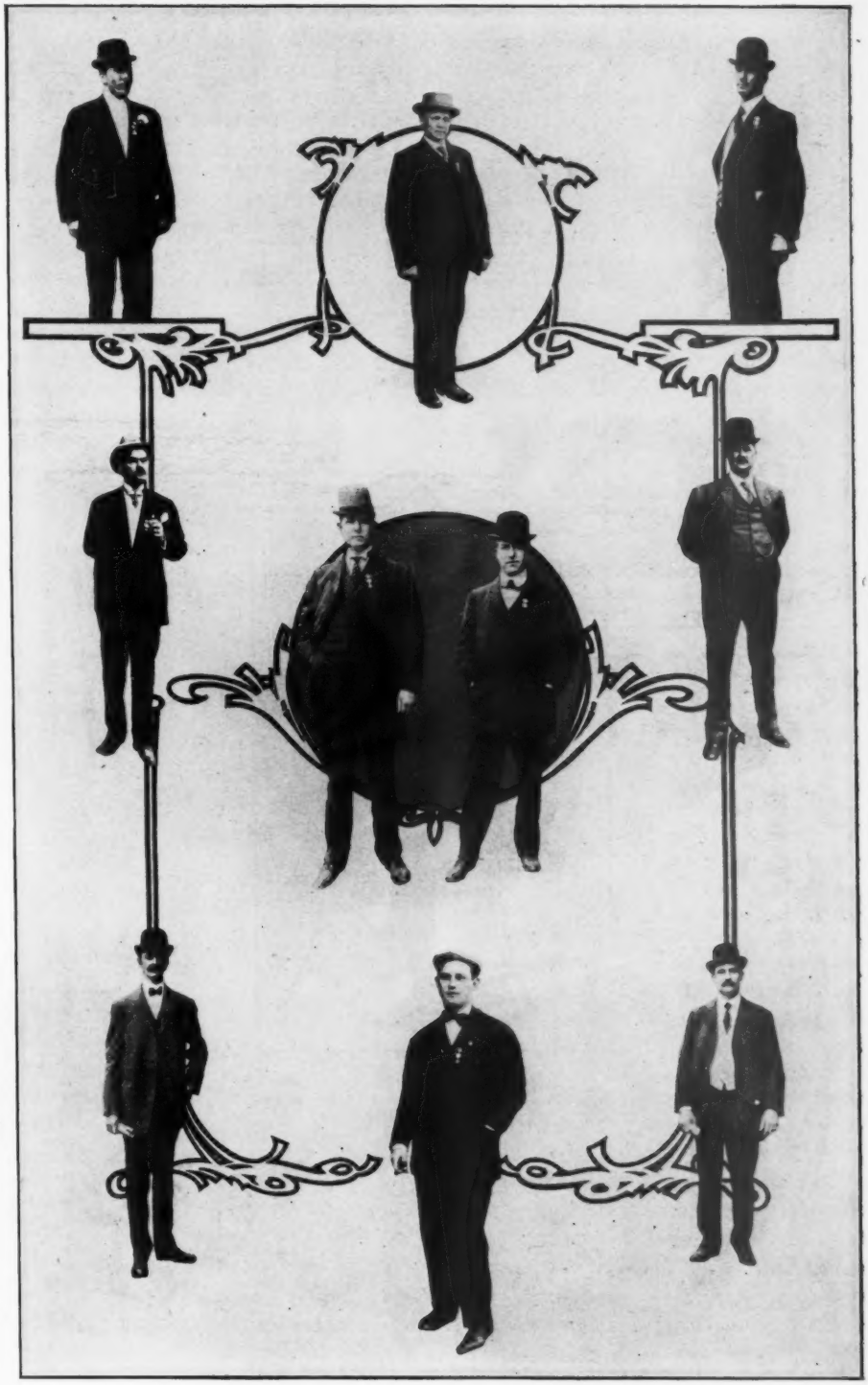
Smoker.

The feature of the smoker at Lulu temple, Tuesday evening, was the presentation to Dr. Richard Moldenke of a handsome silver loving cup and $1,200 in newly coined gold pieces from the Philadelphia mint. The presentation was made by H. E. Field, Pittsburg, who, in a few well-chosen words, presented the gift on behalf of the foundrymen of America. Dr. Moldenke was taken completely by surprise and was visibly affected. He was given three rousing cheers.

The nominating committee appointed by President McFadden to select candidates for the various offices of the American Foundrymen's Association to serve during the coming year was announced at the close of the session Tuesday afternoon. It was composed of J. S. Seaman, Pittsburg; A. Walker, Boston; Geo. C. Davies, Philadelphia; L. L. Anthes, Toronto, Can., and Thomas Sheriffs, Milwaukee.

Wednesday Morning.

A much larger attendance of brass foundrymen and representatives of allied trades was present in the convention hall Wednesday morning, when Chas. J. Caley, New Britain, Conn., to whom had been delegated the work of organizing this section, called the meeting to order. He delivered a short address on the desirability of such an organization and gave an explanation of the purposes to which it might be devoted. A motion was made that an association of the kind proposed be immediately formed, and that keen interest was taken in this organization was shown by the continuous appeals to the chair for recognition to discuss the subject. Those present were unanimous that such an organization was needed, but there was the desire on the part of some that it be made a clearing house for practical ideas and that it should not be devoted to discussions of technical or theoretical subjects. The suggestion of one speaker that it might also be used as a means of regulating prices was immediately frowned down. In reply to a question as to whether the association would interest itself in aluminum subjects, Dr. Moldenke explained that it was intended to embrace all industries whose product was made from non-ferrous metals. There was some opposition to patterning the association after the other sections in affiliation with the parent body, but this was due to a misunderstanding and was readily explained by some of the brass foundrymen who told of the benefits they had derived from their membership in the American Foundrymen's Association and their affiliation with iron and steel foundrymen. A feature of the discussion that was extremely pleasing to those who had been most desirous for a number of years past of creating a brass association was the willingness of many present to contribute papers for next year's meet-



H. T. Frauenheim C. A. Olsen M. L. Heyl
P. M. Baumgardner G. F. Crivel Joe Dinkelspiel S. T. Johnston
H. G. Lorenz J. S. Smith W. S. Quigley

ing, which set at rest all fears of a possible famine in this direction in the future. After the reading of papers on subjects pertaining to the brass industry, committees on nominations and constitution and by-laws were appointed.

Wednesday Afternoon.

At the Wednesday afternoon session of the convention a number of papers of timely interest and importance were presented and briefly discussed. The exhibits in the exposition hall adjoining the convention room attracted the majority of visitors, however, and the attendance at the session was only fairly large. W. W. McCarter, of Marietta, Ga., spoke briefly on "Some Facts Concerning Trade Schools," confining himself to an outline of the leading points contained in his paper dealing with this phase of educational work. Following this the paper prepared by John H. Shaw, of New Haven, Conn., on "Sandless Castings" was read, a number of molds being exhibited to illustrate the new features developed by the author.

H. E. FIELD ABSORBED IN THE DISCUSSION OF "MANGANESE IN CAST IRON"

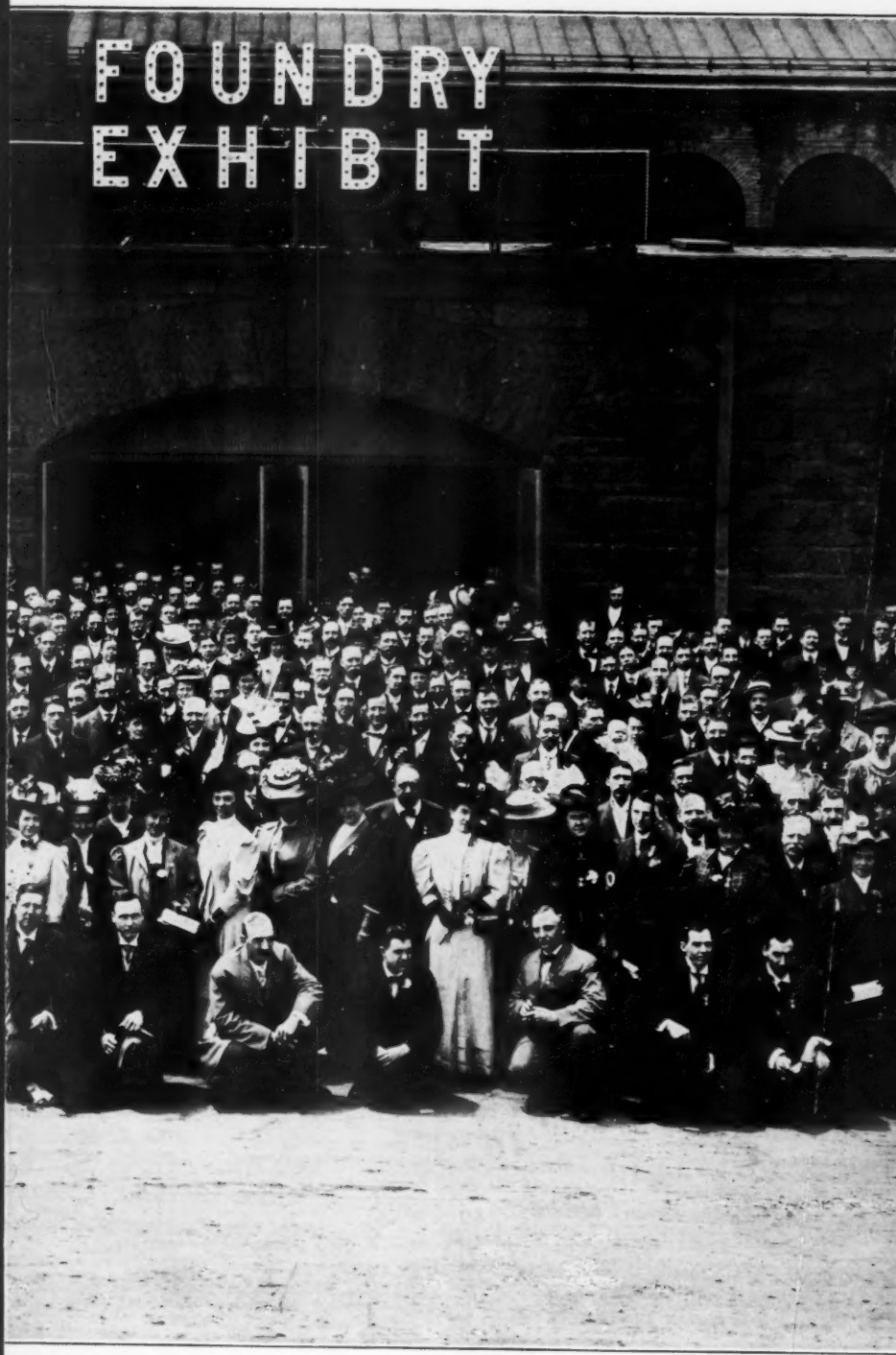
T. Coggershall, superintendent of the mechanical school of Girard College, told of the work in foundry, blacksmith and allied lines at that institution and extended an invitation to the convention to make an inspection of the college. About a score of boys in attendance there were present and occupied seats at the front of the hall while Mr. Coggershall spoke. "The Training in Foundry Work at Pratt Institute" was outlined by Prof. Wm. C. Stimpson, of Brookyn, lantern slides being used to make clear the methods there employed. The subject of industrial training was further considered by E. A. Johnston, of the Winona Technical School at Indianapolis, who showed several castings made by the students and explained the work at this well known institution.

One of the topics of chief interest brought before the convention was that of "Uniform Cost Accounts for Jobbing Foundries, as Recommended by the Jobbing Founders' Association." In the absence of H. D. Miles, of Buffalo, this report was made by J. S. Stirling. A variety of blank forms was presented. Following this a large number of interesting views illustrating industrial betterment work were shown by H. J. F. Porter, of New York. The session was concluded by E. Ronceray, of Paris, France, who explained his universal system of molding machines and new method of preparing molding sand. Extremely satisfactory cinematograph views made clear many points in this interesting discussion.

Great Crowd at Armory.

Wednesday evening was given over to a general inspection of the exhibits of the Foundry Supply Association, and the big armory which served as an exhibition hall was thronged with visitors. While there were many

MEMBERS AND GUESTS OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION AT PHILADELPHIA, MAY



OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION AT PHILADELPHIA, MAY 21, 1907.

ladies and local visitors in the hall on this occasion, comment was general among the exhibitors on the keen interest manifested in the machines and equipment shown. Demonstrators were kept busy throughout the evening and the hall was crowded until a late hour.

Final Business Meeting.

Because of an accident suffered by President McFadden the evening before, the chair was occupied during the Thursday morning session by Vice President C. J. Caley. Following up the extensive discussion of that subject on the previous day, Dr. Moldenke moved that a committee be appointed to take up the question of closer relations between trade schools and shops. The announcement of the personnel of this committee was withheld until later. But one technical paper was presented at this session. Alfred Sang, of Pittsburg, gave a brief outline of his interesting paper on "The Art of Galvanizing," after which the clearing away of a few minor details left the election of officers and the selection of a meeting place in 1908 the only task before the convention.

FRED BLUNDELL POURING A HEAT AT ATLANTIC CITY

The New Officers.

The report of the nominating committee was presented by J. S. Seaman, of Pittsburg. Its recommendations, which were enthusiastically adopted, provided for the following official staff for the ensuing year:

President, Stanley G. Flagg Jr., Philadelphia.

Vice presidents, First district, C. J. Caley, New Britain, Conn.; Second, John W. Burr, Brooklyn; Third, H. E. Field, Pittsburg; Fourth, J. H. Whiting, Chicago; Fifth, A. K. Beckwith, Dowagiac, Mich.; Sixth, T. W. Sheriffs, Milwaukee; Seventh, J. P. Golden, Columbus, Ga.; Eighth, L. L. Anthes, Toronto, Can.

Secretary-Treasurer, Dr. Richard Moldenke, Watchung, N. J.

On motion of Mr. Seaman, a vote of thanks was tendered the retiring president, Mr. McFadden, and he was elected an honorary member of the association. Dr. Moldenke was likewise honored, and the appreciation of the convention was expressed to the Philadelphia Foundrymen's Association, the entertainment committee, the Foundry Supply Association, the readers of papers and all others who helped in making the event of so successful a nature.

The Next Meeting Place.

When the question of the next meeting place was brought up, Dr. Moldenke told of the plan pursued by the association in shaping its affairs so that the place or at least the locality of meeting two years ahead is always kept in mind. He stated that an official invitation had been received to hold the 1908 gathering at Toronto, Ontario, with the probability that a

year later the association would meet in Cincinnati or some other convenient point in the central states. The Toronto invitation he favored accepting because of its influence in bringing the foundry interests of two nations closer together. The invitation of Toronto was then formally presented by L. L. Anthes in a vigorous talk on the growth of the association among the Canadian brethren. Two years ago, he said, but one foundryman from the Dominion visited the convention; last year there were a dozen; at the present convention, a hundred Canadians were among the visitors. "Next year at Toronto we will have six hundred." Mr. Anthes said he had been delegated by the mayor and corporation of the city as well as by many associations to urge the acceptance of Toronto as the next meeting place. The convention was apparently well pleased with the idea of meeting there, but the question of whether or not the selection of a city outside the borders would work to the detriment of exhibitors because of custom regulations was brought up and caused considerable discussion. Mr. Anthes explained that he had a letter from the minister of customs stating that all exhibits would be admitted under bond and that the exhibition hall would be made a bonded warehouse, thus removing this source of difficulty. The suggestion was made that the exhibition be held separately, at some such point as Niagara Falls and that at the close of the regular sessions, the convention adjourn to spend a day or two at this place. The invitation of Niagara Falls was formally presented, but vigorous opposition devoloped against any plan entailing the separation of the convention meeting place and the exhibition hall and the matter was finally referred to the executive committee for definite action.

Brass Founders Organize.

At a meeting held in the convention hall, Thursday morning, final action was taken for the formation of a separate organization of the brass founders and workers in other alloys. A constitution was adopted, with the understanding that it would be amplified and altered in such a manner as the experience of the organization during the coming year should indicate as necessary. The organization is to be known as the American Brass Founders' Association. Several other names were suggested, among them the Alloys Founders' Association and the American Brass and Bronze Founders' Association, but the name originally hit upon was decided to be sufficiently comprehensive, although the new association is to be wide in scope and to include workers in the various alloys.

Entertainments and Visits.

The entertainment features were carried out on an elaborate scale and in addition to the smoker on Tuesday evening included a river trip on Wednesday afternoon to Washington park, where a shad dinner was served. A stop was made at the Otto Hoffman by-product coke plant of the Camden Coke Co., and an opportunity was afforded the visitors to inspect the works. A number of the members joined the ladies on a trip to Atlantic City on this day. Many of the visitors also availed themselves of the opportunity afforded to visit a number of plants in the city of Philadelphia. That a large number might be interested, plants were chosen doing a variety of work. For those desiring to visit foundries making a specialty of pipe and heavy machinery, the Camden Iron Works, Camden, N. J., was chosen. The engineering laboratory of the University of Pennsylvania was also visited by a large crowd. Another party inspected the malleable foundry of the Thos. Devlin Mfg. Co., at Burlington, N. J., and for those interested in steel casting a trip was made to the plant of the Seaboard Steel Casting Co., at Chester, Pa. For those interested in the manufacture of crucibles, the plant of the R. B. Seidel Co. was selected, and the Eynon-Evans Mfg. Co. was chosen for brass castings; heavy machinery, Wm. Sellers & Co.; foundry supplies, J. W. Paxson Co.; stove plate, Abram Cox Stove Co.; light hardware, Enterprise Mfg. Co.

Courtesies to Ladies.

The entertainment features for the visiting ladies were well planned and included

A GROUP OF FOREMEN ON THE GOOD SHIP DEFENDER

WEST & GOBELLE PROVE AN ALIBI

GILMOUR, THOMPSON AND GARTSIDE

MALONE ENJOYS A HIGH ONE

a visit to the exhibit of the Foundry Supply Association and the opening session of the American Foundrymen's Association at the Second Regiment Armory, on Tuesday morning, and a theater party in the evening. On Wednesday afternoon, the party was taken on a drive through the parks and many stops were made at places of historical interest. On Thursday the ladies were taken on a trip to Atlantic City. The headquarters for the visiting ladies was maintained at the Bellevue-Stratford hotel, where a secretary was in constant attndance during the convention. The committee in charge of this feature included Cyrus Borgner, chairman; Alex. E. Outerbridge Jr., W. H. Ridgway, Edgar S. Cook and Geo. C. Davies, together with the following ladies: Mrs. John Q. Adams, presiding; Mrs. Charles W. Ashbury, Mrs. Cyrus Borgner, Miss Marie Borgner, Mrs. Edgar S. Cook, Mrs. Edward B. Cook, Marie Borgner, Mrs. Edgar S. Cook, Mrs. George C. Davies, Mrs. Thomas Devlin, Mrs. Frederick M. Devlin, Mrs. Walter E. Devlin, Mrs. T. F. Devlin, Mrs. Howard Evans, Mrs. Stanley G. Flagg Jr., Mrs. William S. Hallowell, Mrs. Frank Krug Jr., Mrs. August A. Miller, Mrs. E. H. Mumford, Mrs. Alex. E. Outerbridge Jr., Mrs. W. H. Ridgway, Mrs. J. H. Sheeler, Mrs. William O. Steele, Mrs. Josiah Thompson, Mrs. Harry L. Tripple, Mrs. A. T. William.

CAST THREAD FITTINGS*

HENRY B. CUTTER

WHEN the request of your secretary was received to present at this convention, the subject of making gray iron castings that did not require machining, it was stated that foundrymen throughout the country were much interested in the subject. While acceding to the request, it seemed almost presumptuous on my part to undertake the presentation of such an important subject, particularly as your orator's experience in foundry work covers a period of less than four years. I have been assured, however, of your kind consideration and friendly criticisms.

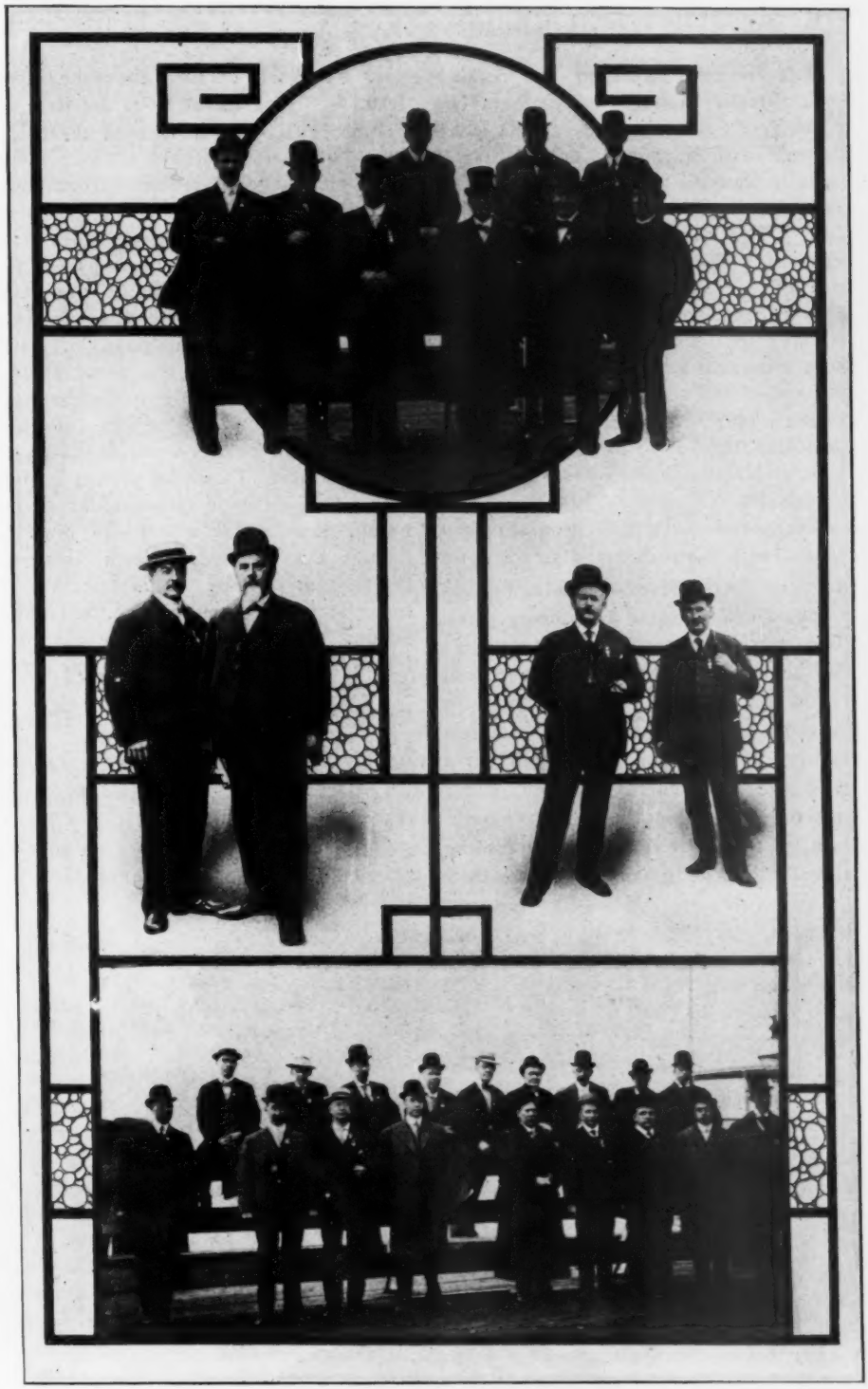
The principle and method of making gray iron castings with threads cast in them was evolved by George Cowing, of Cleveland, about 1878. The development of castings thus made was coincident with the development of the pump industry in which Cowing & Co., Seneca Falls, N. Y., were leading factors. This method of making castings with cast threads was applied to the manufacture of pumps where different parts were to be screwed together, and was employed exclusively by this company in its works from the time of its inception to the practical abandonment of the business. It was found to have been a marked point of economy in the manufacture of pumps, and enabled the manufacturers to produce superior goods.

The making of gray iron castings with cast threads was for many years an incident correlated to the manufacture of pumps, but since the organization of the Cast Thread Fitting & Foundry Co., the making of gray iron fittings with cast threads has been carried to a much higher degree of perfection than had hitherto been thought possible, both as to quality and economy in methods of production.

Recent tests with a number of these fittings screwed together with wrought iron pipe having standard gage cut threads, the joints having been made up without the use of any dope other than lubricating oil, showed no indication of break-down under a pressure of 900 pounds to the square inch.

Erroneous opinions have existed among foundrymen in general regarding the method of producing castings with the threads cast in them, as it had been considered by many that it was done by the use of chills, thereby producing a hard brittle thread which would be liable to break in making up.

*Presented at the Philadelphia convention of the American Foundrymen's Association.



THE PITTSBURG DELEGATION

P. C. SMITH, DR. EDWARD KIRK F. N. PERKINS, C. DALTON

THE CLEVELAND CONTINGENT

This method, however, has not been employed.

The method pursued in making cast threads in gray iron fittings has been by the use of seamless sand cores formed without the fin or rib that is usually caused by the sections of a core box and which require dressing off. The thread of these seamless cores are formed in the sand by the use of special devices. The dies of the thread forming devices are made of high grade steel and are subjected to a minimum amount of wear. When once made to standard gage they will produce duplicate thousands of these seamless thread cores without variation, and being thus made, are perfectly round.

The seamless thread cores are then joined with the ordinary plain or body cores by the use of arbors, and are placed in the mold the same as ordinary cores. The special mixture and the fineness of the sand from which these thread cores are made, produce a clean sharp thread in the casting. The methods employed in uniting the thread cores with the plain cores are such, under improvements recently put into operation, as to render it impossible for the threads in the castings, where they come at opposite ends of the fitting, to be out of alignment.

It has been claimed that the contraction of the metal from the time it is poured into the mold until the cooling of the casting would produce sufficient shrinkage to render the making of cast threads unreliable and variable. Such a condition, however, does not exist in practice, and is perhaps due to the fact that the solid core prevents a shrinkage which might otherwise occur. The metal in the threads of castings thus made is of the same structure as that in the body of the casting, only having on the surface of the thread a thin film present on all gray iron castings. This film proves to be of great benefit in practice, as it is harder than metal where the film is cut away, as is the case with standard threads cut on pipe. This cast thread being standard, true to gage, and possessing the hard film of the casting, forces the cut thread of the pipe into a perfect union.

Regarding the iron used in making gray iron castings with cast threads, ordinary foundry practice is pursued, care being exercised in the mixture of the iron, which, when carried out by the usual methods of mixing by analysis, produces clean, sharp threads.

SILVER PUNCH BOWL PRESENTED TO DR. RICHARD MOLDENKE

THE UNIVERSAL SYSTEM OF MACHINE MOLDING*

French Method Devised for the Manufacture of Pattern and Stripping Plates in the Foundry instead of the Machine Shop

E. RONCERAY

IT is perhaps a great temerity for an inhabitant of the old continent to dare to come over here and talk to you about an improvement in machine molding. You have the reputation all over the world of being far ahead of we Europeans, and you are so alive and quick to improve your methods, that I have been considered somewhat of a fool, when advising my friends, that in May, 1907, I would cross the Atlantic for the simple puorpose of exhibiting our Universal molding machines in operation at the American Foundrymen's Association convention, with the hope of arousing interest therein to some extent.

I have heard that, although you are quick to improve your methods, you also welcome all new things, provided they are good, and I have been told that mine are good. You have perhaps read, in some of your technical papers, such as *American Machinist*, THE FOUNDRY, *Machinery*, and other periodicals, both American or foreign, contributions about what we have called "The Universal System of Machine Molding."

THE FOUNDRY, among others, in its December issue, stated that the way we worked the problem of machine molding differed from your ways, but that when the same task is given to several bright individuals to perform, each is sure to have some good points in his method of solving the problem. I want to thank the editor for this kind appreciation, but perhaps, he might have added that, if the solution of the problem is different, it is because the conditions were also different. In America, you have a market, not only larger than the French, English or German markets, seperately, but even larger than all the European markets combined. Consequently, when we Frenchmen have an opportunity of making one dynamo, you can make a hundred; where we make 10 gas engines, you make 1,000; and where we make 100 castings, you make 10,000. This is enough to show how different are the proulems we have to solve, even when they appear to be the same.

Receiving such large orders, you do not hesitate to spend money on pattern plates and special molding machines, the expense per casting being reduced to a trifle on account of the quantity of castings you have had to make. You have gone as far as to design the castings, and make the patterns to suit the molding machines. In France, we have had to deal with small orders, with patterns made for molding by hand, and the castings are very often designed by draftsmen who have never seen a mold in their lives.

We have had to find something to meet the demands of our growing automobile industry. Up to the present time, in France, this industry has not been standardized, and consequently the castings are the most intricate that can be found. Furthermore these castings are always wanted in such a hurry that it seems as if the automobile manufacturer wants to get his orders through at the same speed that he runs his cars. Consequently, the orders be-

*Presented at the Philadelphia convention of the American Foundrymen's Association.

ing small, we have had to make our pattern plates quickly and cheaply, and to make them from the ordinary wooden patterns for any intricate casting. After that we had to design machines for using these pattern plates and making castings from them.

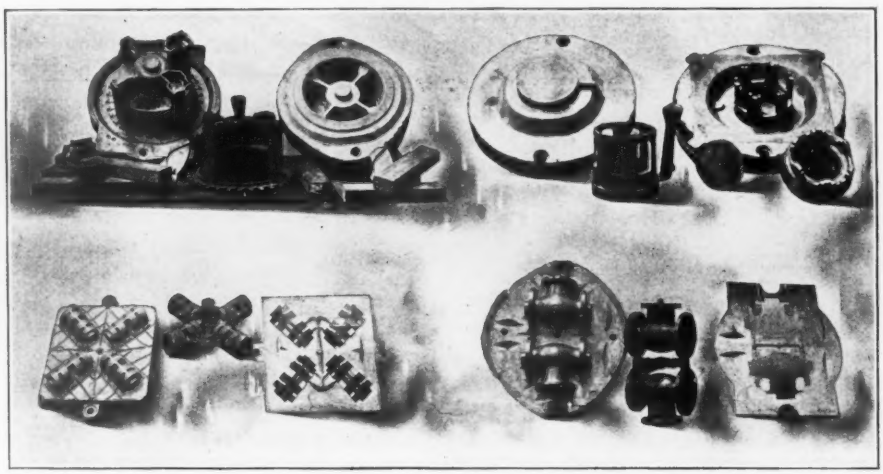
There is no need of telling you that the problem was rather difficult. Nevertheless, after a heavy expense, time and with the help of several bright foundrymen and mechanics, it has been solved, and I am only too pleased to present to you today the results of our efforts, in the hope that they will be of some interest.

The pattern plates we make, which are covered by several patents, are of different types, or more definitely, are a combination of different systems. We will examine them quickly, and, if any further information is desired, I shall be glad to give it.

The whole system has been devised with a view of making pattern plates and stripping plates in the foundry, without the help of the machine shop. There is no need of mentioning to an assembly of founders the trouble and delay involved in obtaining a pattern or a pattern plate from a machine shop, and when after a lot of difficulties, and wasted time, it is secured, in most cases it is useless.

To make a good pattern plate it is necessary for one to be a good molder, a good fitter and a good patternmaker, which accomplishments are rather difficult to find in the same man. Our processes have the advantage of obviating these difficulties and result in a considerable reduction in the cost of pattern plates. Our patterns are adaptable for any castings required by the trade, provided 50 castings or more are made from the same pattern.

It is needless to emphasize that these results will widen the field of machine molding considerably, which has up to the present been confined to a definite class of work. According to my understanding of the situation, I claim that if 10 per cent of the total tonnage of castings, under 500 pounds have been machine molded up to the present, 50 per cent at least, will be molded in the future by the use of these new methods. One of the main



FIGS. 1, 2, 3 AND 4—EXTENSIVE AND VARIED USE OF STRIPPING PLATES

NINE STRIPPING PLATES AND FOUR PLUGS IN THE TWO BOTIOM PLATES

STRIPPING PLATE WHICH IS ALSO PART OF PATTERN AND CORE PRINT

ANOTHER TYPE OF STRIPPING PLATE

PLAIN STRIPPING PLATE

points is the method of making stripping plates.

Every founder knows the numerous advantages of stripping plates and also the various schemes that have been invented to do away with them, on account of their high cost and the impossibility of adapting them to crooked joints or intricate castings. In spite of the ingenuity spent here in power ramming machines, hand stripping plate machines still have a good reputation, made of cast iron. Let me call your attention to Fig. 5, which illustrates an instance with which loose parts, in fact, a considerable number of them, can be used on certain plates. In this case not less than 25 stripping plates are used and very often we take twice as many.

When the casting is not very large, and is of such shape as to allow it, we use reversible plates, disposed with top

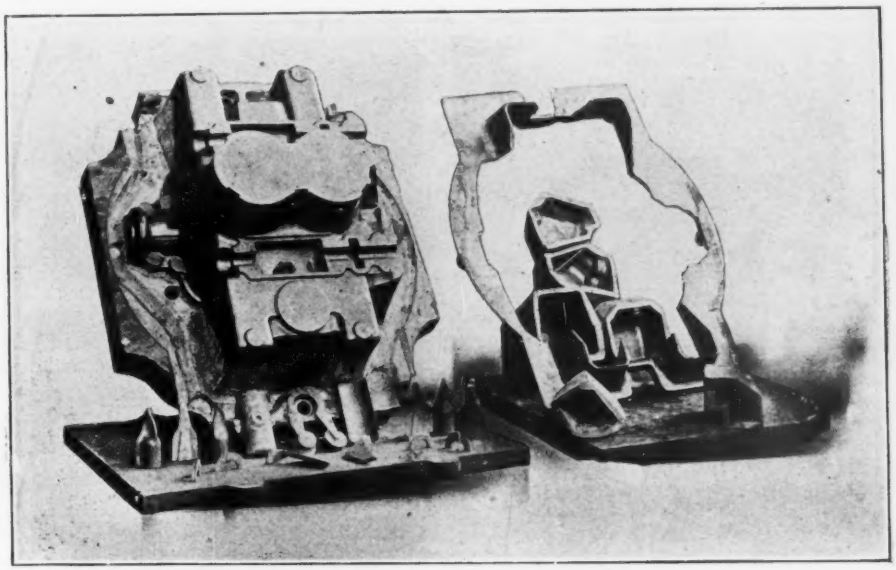


FIG. 5.—EXTENSIVE USE OF LOOSE PARTS ON STRIPPING PLATES

and are certainly capable of turning out fine castings. The way we make stripping plates enables the founder to use them in profusion whenever there is the slightest danger of the sand breaking, or, as we express it in French, he uses the stripping plates—"a toutes les sauces." The result is that we are absolutely certain of getting a good mold at each ramming, as far as this side of the question is concerned.

Figs. 1, 2, 3 and 4 illustrate clearly to what an extent we use stripping plates, and an inspection of them will quickly show that no fitting has been done. These stripping plates are usually made of a non-contracting metal, but in special cases they can readily be and bottom of the same pattern, side by side, so that two flasks rammed on the same pattern plate, constitute a complete mold. Similar work has previously been done by setting half patterns on a plate, but in our process, we obtain it simply by molding, even if the joint is very crooked, and the pattern plates thus obtained are always absolutely accurate. Figs. 6, 7, 8 and 9 show a few examples of this arrangement which has proven to be most useful in a number of cases.

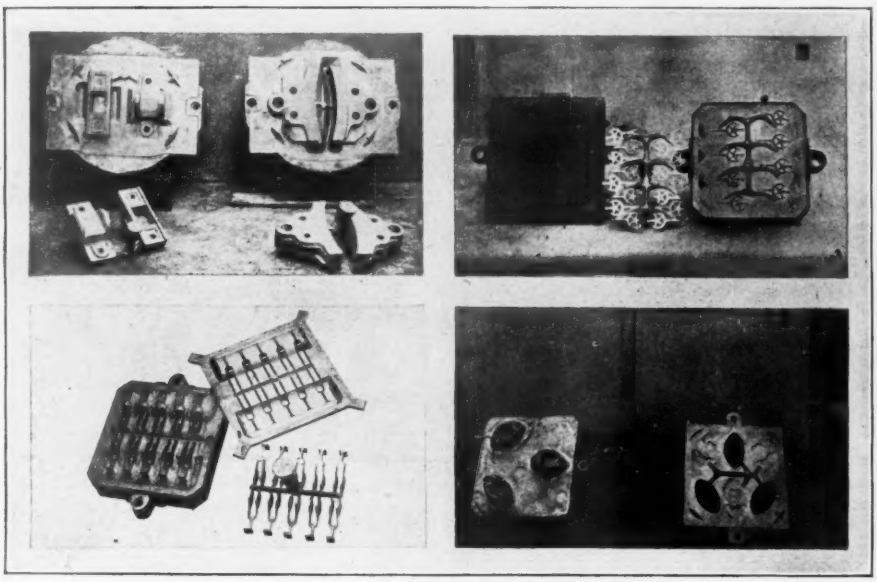
A peculiarity of this reversible system is that, when a side of the casting is flat, or almost flat, a great saving in space is effected by setting castings edge to edge. Fig. 10 shows a good example of this arrangement which ef-

fects a saving of 30 per cent of space in certain cases.

A special application of the reversible process is its use for making what we have called "Cliche." The cliche is a small reversible pattern plate, entirely metallic, of constant width but of variable length, containing as many of the articles to be molded, as can be inserted in its surface. These cliches, which are readily obtained, are inserted in a special frame called a "cliche table," the number of them varying according to their length, and this table itself forms a reversible multiple pattern plate, variable at will in its composition.

The main advantage of the cliche system is that the founder can easily remove and replace any of the cliches from the cliche table, and never make more molds than are required of any pattern ordered, which is an important saving. The cliches are kept in store and are always ready for any repeat order of the same article.

It is necessary to add that the time of manufacturing a pattern plate, by these processes, varies from one or two hours for a cliche, to several days for the most complicated plates. Perhaps, it may be well to state that the pattern plate, as we have conceived it, is a strongly built contrivance, strong not only by reason of its elements, but more especially by its design. It is composed, as a rule, of a base formed by an iron-frame, filled with plaster, upon which are set the patterns composed of a thin shell of white metal filled with plaster, on which they rest during the ramming action. It is evident that it is quite different from the pattern plates and stripping plates known in America.



FIGS. 6, 7, 8 AND 9—EXTENSIVE USE OF PATTERN PLATES

I will now discuss the machines we have designed to complete this line of new devices. We, of course, can use ordinary pattern plates, and with slight alterations, even vibrating pattern plates. But our machines give their maximum results with our system of pattern plates and stripping plates.

Makers of molding machines have numerous styles, and in each style a number of sizes. It is generally claimed to be a talking point. We, on the contrary, except a few special machines only used for very special cases, have only two styles of machines and each style is limited in sizes. Each of

our machines can handle all sorts of castings up to its maximum capacity, from the most simple up to the most intricate, using flasks of many different sizes and shapes up to the maximum capacity, which no other machine on the market has been able to accomplish up to the present. This is the reason we have called our machine Universal, and in our opinion, it is a great point in our favor. In fact we consider that this small number of machines is the best proof that the system is universal, and I have no hesitancy in saying, covers a much wider field than the many

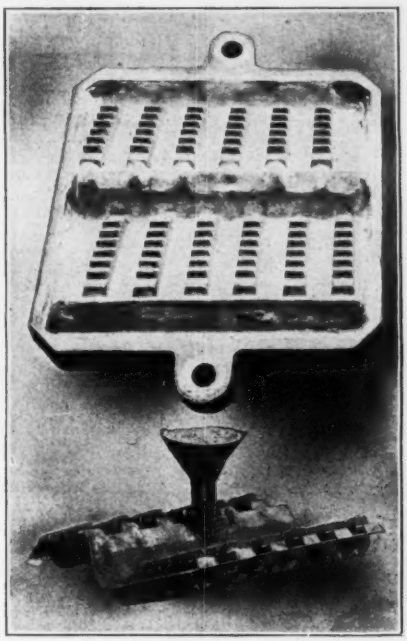


FIG. 10—CASTINGS SET EDGE TO EDGE TO ECONOMIZE SPACE

machine built up to the present.

The universal machines are made standard and swinging, the former in six sizes ranging from 10 x 10 inch flasks up to 5 x 4 foot flasks and even larger. The latter in four sizes covering the same range making 10 sizes in all.

To operate our machines the agent selected is hydraulic power, instead of compressed air generally used here. This agent has been chosen after careful examination, and was not left to

FIG. 11—MOLDING MACHINE WITH SWINGING HEAD

chance. I fail to agree with most of your manufacturers, who hold that compressed air is necessary for machine molding, and I will explain my reasons for this. Compressed air is usually available at a pressure of 80 to 100 pounds per square inch. This low pressure leads to the adoption of a big cylinder to obtain sufficient pressure to ram the mold, but as a rule,

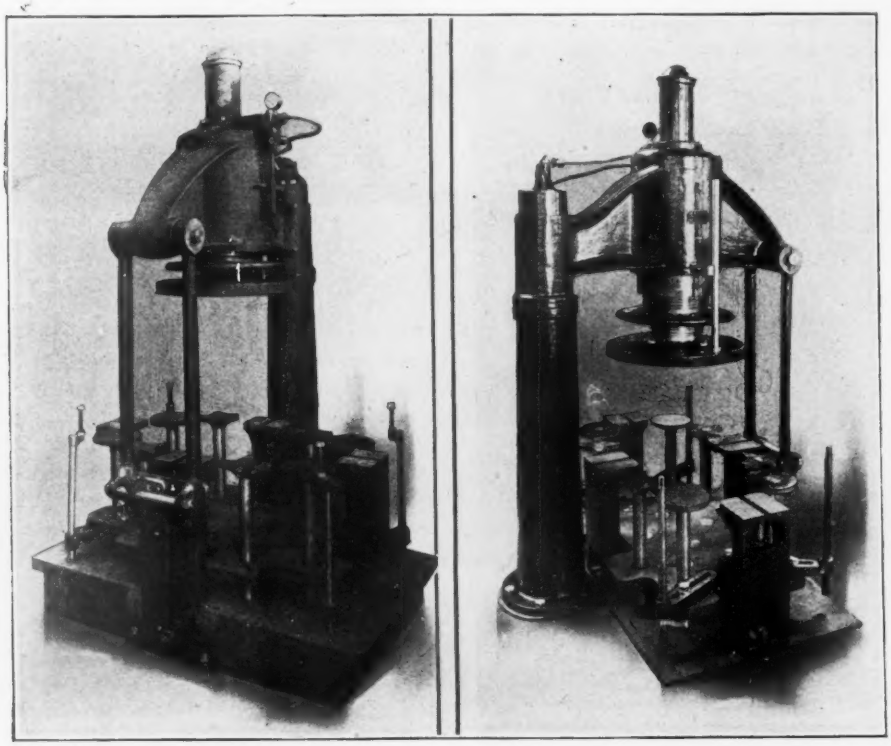
FIG. 12—AUTOMATIC SAND DISTRIBUTOR

the static pressure, even with such big cylinders, is not sufficient, and it is then necessary to give blows. You have all experienced this action which is much like the one of a steam hammer, and you know, how destructive it is, both to the pattern plates and the machines.

Regarding the drawing of the pattern, compressed air being an elastic fluid, is not at all adapted to this kind of work and to properly perform this operation it has been found necessary, either to draw the pattern by hand or to use what I have no hesitation in calling very ingenious devices but which however are somewhat complicated. Hydraulic pressure can be obtained high enough to use static pressure for ramming with reasonable sizes of pistons, and I consider this a great advantage.

You not only get the exact pressure necessary by the use of a gage and so have it under perfect control, but also by simple arrangements, you can obtain more or less pressure as required, hard in some places and soft in others, which is necessary to obtain good work.

For the drawing of the pattern, the gentle and steady motion of hydraulic power is exactly what is necessary and permits the use of time saving devices, to which I will refer. Another important point is the power consumed. As an average compressed air machine requires about four horsepower, our machines and arrangements accomplish the same work with 1-5 horsepower or 20 times less.



FIGS. 13 AND 14—MACHINE DESIGNED FOR LARGE WORK

One may advance an objection by saying that water may freeze in cold weather; in spite of the fact that all modern foundries are heated and a lot of hydraulic appliances are used in metallurgy without trouble. I wish to call your attention to the fact that nothing is simpler than making a return to the tank and then using a non-

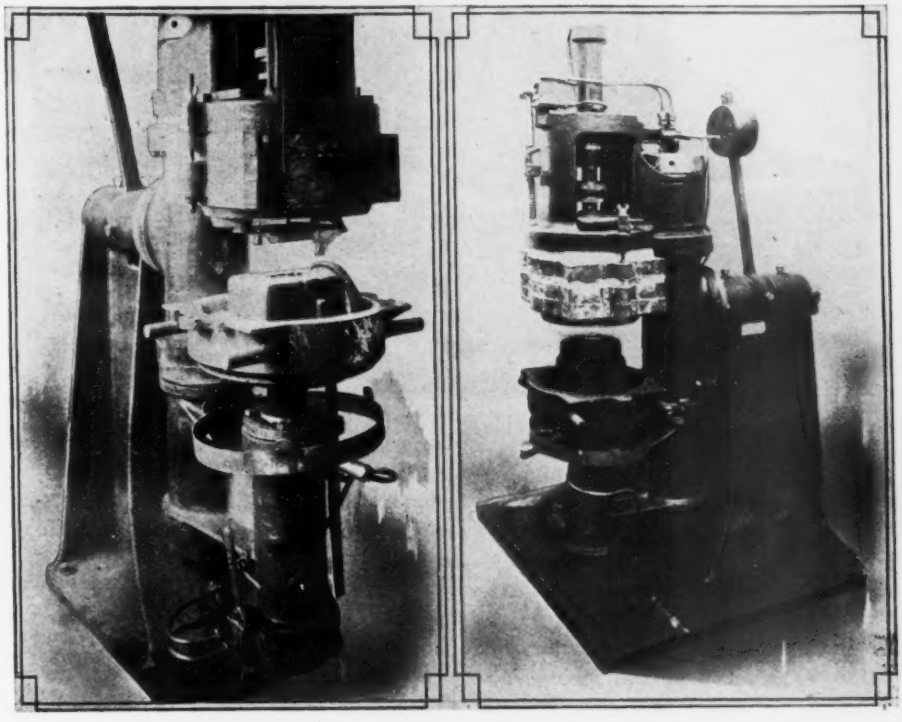
freezing mixture, such as alcohol or glycerine, in the water to prevent it from freezing.

The piping generally used is very small; it ranges from three-eighths inch inside diameter up to one inch for very large plants, but the latter is seldom used.

Our standard machines are divided into two classes, designated as A and M. The difference is only in the detail of the table.

The class A molding machine generally consists of a box or pedestal, the top of which is a table on which the pattern plate is fixed. A swinging beam pivoted on the back column, carries the hydraulic piston for ramming the sand, and a moveable hook placed at the other end of the beam, allows it to be fixed in the right position for ramming. The height available above the table can be adjusted by a telescopic screw, reducing the stroke to its minimum in each case and then saving water and time, while striking off sand is avoided owing to the perfectly flat surfaces so obtained. Inside the box is a vertical hydraulic ram carrying a moveable table. This ram is provided for drawing the mold from the pattern

FIG. 15—SWINGING MACHINE



FIGS. 16 AND 17—MACHINE FOR SMALL WORK

plate after ramming. For this purpose, the table carries four adjustable brackets holding four vertical rods, which work outside of the body of the machine, and engage the corners of the flasks, or of the stripping plates, so that an absolutely true lift is obtained.

In a few special cases, where long cores, gears, etc., have to be dealt with we recommend the installation of the machine with a double ramming device, which insures an equal pressure, being exerted over the whole length of the core or gives an additional ramming in the weak parts of the mold. The swinging beam has the advantage of leaving the access to the flask entirely free for the operator to move around which is shown in Fig. 11.

Recently the machines have been fitted with a special treadle arrangement for drawing the flask.

The cinematograph pictures of the machine in operation enable you to follow the assembling machine, which makes what we call "Mottes", in a much better and accurate way than snap flasks.

A useful addition to such a quick machine is the automatic sand distributer, Fig. 12, which consists of a hopper in which the sand is fed by a mechanical device, depending on the general arrangement of the foundry and

FIG. 18—LARGE SPECIAL MOLDING MACHINE

under which a swinging box is filled with sand and emptied when above the flasks. The opening and closing of bottom of the hopper and box are obtained by a simple motion backward and forward of a lever worked by the man operating the machine. This device saves all shoveling and consequently considerably increases the output. The cinematograph shows you the speed with which molds can be produced.

Class M machines, Figs. 13 and 14 have been designed specially for large work, as mine shafts and tunnel segments, truck bolsters, four and six cylinder automobile casings, large valves, etc. The chief difference as compared with the other machines is in the adaptability of the table to the requirements of the castings to be made.

With the standard universal machines previously described practically all molds can be produced, but, when heavy pockets of sand have to be lifted, the use of gaggers becomes a necessity. This renders the ramming uncertain and tedious, and the use of the swinging universal machine overcomes this difficulty. These machines are also very useful when the sand has no binding power, especially for the production of drags, which, after their ramming on the machine, are turned over into their pouring position. In their main points, the swinging machines are very much like our standard types, only having a longer ramming stroke and a shorter drawing stroke; but they are pivoted on a horizontal axle which is placed about the center of gravity of the machine, when loaded with the mold.

The operation of these machines is similar to that of the standard machines, but when the mold is under pressure, the whole machine, with pattern plate and mold, is revolved 180°, to draw the mold on its base, as shown in Fig. 15.

The swinging machines can, occasionally, be used as standard machines, and, in that case their operation is exactly the same as the standard type. When used as swinging machines, their operation is decidedly different. The ramming piston is not only used for ramming, but also for drawing the mold, and the function of the opposite piston is to help the starting of the sand at the beginning of the drawing operation and then stop, when the mold is out of danger. In fact, the mold is at first supported by the two pistons, the ramming piston carrying the ramming plate, and very often a follow board and the drawing piston, to which are attached our usual stripping plates and stools, instead of being loose, as in the case of the standard machines. At a certain point the drawing piston together with its attached stripping plates and stools is stopped while the ramming piston continues lowering down, thus accomplishing the drawing of the mold.

I confess that when we conceived the idea of this machine, we had grave doubts as to its success, and decided to make at first a very small machine. After a good many alterations we were successful, and with practice all doubts were dispelled and we have now made very heavy machines of this style for many classes of work.

Figs. 16 and 17 illustrate a small machine for 14-inch flasks. The first view shows the molding of a pot which is a very simple job, but which is accomplished very rapidly. Fig. 17 shows the molding of the drag of an open railway axle journal box (German type) together with all cores. This is interesting as the output is not much smaller than when the pots are made.

Fig. 18 shows a very large special machine made for cotton cording machinery.

TABLE OF VOLUMES.

"A Table of Volumes through Air-Ways" has been compiled by C. H. Kuderer, Avonmore, Pa. It is a handy and ready reference for engineers who meet with problems of air transmission through large air ways. The table is printed on stiff cardboard and is sold by E. E. Meyer, Allegheny, Pa., at 25 cents per copy.

COMPARATIVE CUPOLA PRACTICE*

W. S. McQuillan

AT the January meeting of the New York Foundry Foremen, the subject of cupola practice and melting ratios was brought up for discussion. Accordingly a list of questions was submitted to about 30 foundrymen, and they were requested to answer as accurately as possible regarding the working of the cupolas in their charge. About 20 answers were received, most of which have been tabulated in tables I and II for comparison. Some were received, which were not fully carried out, and could not, therefore, be used very well, and still others, owing to the odd construction and shape of the cupola, could not be analyzed for comparison, and had to be left out of this paper.

While some of these records would make interesting studies in themselves, the figures in the tables, are approximate, and while, it is not claimed that they are correct in every particular, it is believed that they are a fair comparison and show the results obtained from a number of different cupolas, with the varying conditions under which they were worked.

Fuel.

The volume of coke was figured from 100 pounds of good Connellsville coke which measured 5,264 cubic inches, and of hard coal, at about one-half the volume of coke, as it was found that some foundrymen use coal and coke on their bed charge. It has been stated that the cupola is one of the simplest devices for melting cast iron, which may be true, but where speed, economy, and quality, are desired, a thorough knowledge of the conditions, and workings of the cupola are very essential. There are certain fixed laws governing the melting of iron in a cupola. If the conditions are made proper and in accordance with the requirements of the laws, certain definite results are bound to follow. A given quantity of heat imparted to a certain amount of iron, will bring about the change which we call "melted." Cast iron melts ordinarily, at about 2,200 degrees Fahr., but there are a few foundrymen who would find it fit for use at this temperature, as it would be so near the actual melting point that it would quickly chill back to the solid state before it could be poured. As this temperature causes the metal to just run, it is evident that it must be treated much higher in order to have the iron retain its fluidity after being taken from the cupola. It is generally understood that the portion of the fuel below the tuyeres is not capable of giving this extra heat, and hence the metal must receive it before it drops below this point. We must therefore, look to the fuel above the tuyeres to furnish this heat as the metal drops through on its way to the bottom. So we find that the height of bed above the tuyere is of much importance in giving us good hot iron quickly. If the bed is low, it may melt, but dropping as it does, directly into the cold blast as it enters the cupola, it is cooled, and the result is dull iron. We can easily understand by the blocking of the fire, in front of the tuyere after the blast is put on, the effect of the cold air upon the melted metal.

There is the other extreme, having

*Presented at the Philadelphia convention of the American Foundrymen's Association.

Table I.

Report	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Diameter of cupola in inches	32	35	42	42	27	44	44	54	54	58	48	56	60	60	72
Area of cupola in square inches	804	962	1,385	1,385	572	1,521	1,521	2,290	2,290	2,642	1,809	2,463	2,827	2,827	1,071
100 pounds fuel will fill, inches	6.6	5.6	2.3	3.8	9.3	3.5	3.5	2.3	2.3	2.0	2.9	2.2	1.9	1.9	1.3
Weight of fuel on bed, pounds	450	650	1,000	650	350	1,300	1,000	1,400	2,000	2,000	1,300	3,000	1,700	1,800	2,500
Height of fuel on bed, inches	30	36.5	23	26	32	45	31.5	32	46	40	36.5	66	32	34	50
Height of fuel bed above tuyeres, ins	21	29.5	11	15	20	33	25	24	32	24	22.5	40	30	22	26
Height of tuyeres from sand bed, ins	11	7	12	11	12	12	9.5	7.5	14	16	14	25	2	12	24
Weight of coke above tuyeres, pounds	278	470	520	400	215	940	628	800	1,390	1,200	800	1,800	1,575	1,150	1,300
Weight of iron on bed, pounds	1,000	1,300	4,500	1,400	700	3,000	1,000	3,000	6,000	6,000	4,000	9,000	6,000	5,000	7,000
Ratio fuel above tuyeres	3.5	2.8	8.6	3.5	3.2	3.2	1.6	3.7	4.3	5.0	5.0	5.0	3.8	4.7	5.4
Ratio fuel on bed	2.2	2.0	4.5	2.3	2.0	2.3	1.0	2.1	3.0	3.0	3.7	3.0	3.5	3.8	2.8
Weight fuel succeeding charges, lbs	110	125	250	100	90	175	110	300	450	400	200	450	2,000	350	600
Ratio fuel succeeding charges	8.7	10.4	8.0	10.0	4.4	11.4	1.3	10.0	8.8	4.1	10.0	10.0	10.0	11.4	11.7
Weight of iron succeeding charges, lbs	1,000	1,300	2,000	1,000	400	2,000	1,500	3,000	4,000	4,000	2,000	4,500	2,000	4,000	7,600
Total weight of fuel, pounds	1,250	1,850	1,935	2,150	2,000	3,075	2,040	4,800	8,500	4,400	4,100	12,000	6,600	6,600	12,700
Total weight of iron, pounds	8,000	14,000	12,000	16,000	8,000	27,000	14,800	33,000	64,800	30,000	32,000	100,000	49,500	50,000	127,500
Grand ratio	6.4	7.5	6.2	7.6	4.0	8.8	7.2	6.9	7.5	6.3	7.8	8.0	7.5	8.3	10.0
Kind of fuel used	Light Coke	Coke	Coal & Coke	Coke	Coke	Coke	Coal & Coke	Coke	Coke	Coke	Coke & Coal	Coke	Coke	Coke	Solvay Coke
Fuel weighed or measured	M	W	M	M	W	W	W	W	M	W	M	W	M	W	W
Time of putting on blast, P. M	3:00	3:00	3:00	3:00	3:00	3:30	3:15	2:15	2:10	2:00	1:50	3:00	2:45	2:15	2:00
Time first iron melted, P. M	3:10	3:15	3:15	3:05	3:07	3:45	3:30	3:25	2:30	2:15	1:57	3:05	2:46	2:30	2:15
Time first iron tapped, P. M	3:20	3:20	3:30	3:10	3:15	3:50	3:48	2:30	2:50	2:25	2:01	3:20	2:51	2:50	2:22
Total time of heat from blast	2:20	1:30		1:30	1:05	2:00	1:30	1:50	3:00	1:30	3:40	4:30	2:15	2:20	9:45
Iron melted per minute, pounds	130	155		175	123	225	158	300	360	333	145	370	367	360	567
Class of work made	Gas Engine	Plate	Job	Light Job	Job	Boiler & Plate	Pumps & Job	Stove Plate	Boiler & Radiator	Pipe Ftg. Job	Med. Light	Rolls	Plate	Sanitary & Plate	Electrical
Diameter of blast pipe, inches	12	16	14	14	8	15	12	17	18	20	16	24	18	18	24
Area of blast pipe, square inches	113	201	154	154	50	176	113	227	254	314	201	452	254	254	452
Number of tuyeres	6	6* 2¼	6	6	6		8	6	6	6* 3	6	12	8	6	
Size of tuyeres, inches	4½ x 6	5 x 5	4 x 10	4 x 6	4 x 6		2¼ x 11	4½ x 13	10 x 7	7 x 12	4 x 6	6 x 12	4½ x 7½	7 x 10	
Area of tuyeres, square inches	116	170	240	144	144	336	198	429	420	546	144	648	270	420	706
Height of charging door, feet and inches	12	11 6	12	12 6	9 10	11	7 10	9 3	11 6	9	9 9	13 10	9 6	10 6	14
Pressure 20 minutes after blast, ounces	16	16	12	8		9½	13	13	14	16	8	16	8	8	13½
Slag is drawn						After 6 tons,									Every tap
Weight limestone or shells, pounds				75		125			40 per ton		50 per ton			50 per charge	
Do you mill sprue?	No	Yes	No	No	No	Yes	No	No	Yes	No	No	No	Yes	No	No
How often do you line up, months	6	6		6		6	3	6	10	7	6	8 to 10	6	12	6

*Six top and six bottom.

the fuel bed too high above the tuyeres. In this case the intense heat existing in the melting zone is applied to the fuel above it, instead of acting directly upon the metal. We have not only a waste of fuel, but a waste of time waiting for the excess to burn away sufficiently to bring down the irons to the melting zone where they will be melted. Therefore, the height of fuel above the tuyeres is of much importance in getting good hot iron in the shortest time. Care should be taken to see that the bed is neither too high nor too low.

Cupola Efficiency.

The theory has been advanced that a cupola would melt faster around the edges than in the center. Others have claimed that the center would melt the faster. This is not proven by the figures, as we find that a 35-inch cupola melted 19½ pounds to the square foot, per minute, while a 72-inch cupola melted only twenty pounds per square foot, per minute. As the iron from the 35-inch cupola was used for stove plate, we must assume that it was very hot. We also find a 48-inch cupola melting over 15 pounds per square foot per minute, but this may be accounted for by the figures shown. We find that at least two conditions in the 48-inch cupola are opposed to fast melting, namely the use of part coal, and the proportion of tuyere area to the cupola area, which is one to thirteen. Further, only eight ounces of blast obtains, which would indicate that not enough air was furnished this cupola. On the other hand, we find a 56-inch cupola melting over 21½ pounds per minute, per square foot. In this cupola, we find the proportion of tuyere area about one to less than four, with a blast pressure of 18 ounces. We also note that the two 54-inch cupolas, Nos. 8 and 9, are about equal in tuyere area and blast pressure, but No. 9 melts over 22½ pounds per square foot per minute, while No. 8 melts a little less than 19 pounds per square foot per minute. Here, we might assume that the higher fuel bed of No. 8, was the factor which gave No. 9 the faster speed of melting. Now, if we turn to No. 10, a 58-inch cupola, we find a still larger proportionate tuyere area and a smaller ratio per square foot per minute with a higher blast pressure (sixteen ounces.) Here again, we might assume that the fuel bed above the tuyeres is not high enough to produce the best results. As we must remember that the blast pressure will cool a large part of the fuel, and raise the melting zone, so we will say, if this fuel bed was 6 inches to 8 inches higher, the melting rate would be more in proportion with No. 9, or if the blast pressure was reduced two or three ounces, faster melting would result. We may also note No. 4, a 44-inch cupola melting 18.19 pounds per square foot, per minute. The tuyere area here is about 9½ to 1. The blast pressure is low for this proportion, but we may also note that the fuel bed is low and maintained so, by small succeeding charges of fuel and iron. In this cupola we have personal knowledge of the good quality and temperature of the metal produced, and believe these conditions to be due to blast and fuel being kept in good proportion.

Conclusions.

From these few comparisons, we arrive at the conclusion, that fuel and blast must be kept in certain relations to obtain fast and economical melting. There are many other studies that could be made from the tables presented, from which you may draw conclusions which doubtless would tend to establish the following facts: That with a high fuel bed and a high blast pressure the melting zone is raised and a cooling of the fuel around and above the tuyeres results. It also chills the iron and slag over the tuyeres and causes the cupola to bung up at this point. That a high fuel bed and a low blast pressure cause delay and waste of fuel by having to burn out a portion before the iron will reach the melting zone. That a low fuel bed and a high blast pressure will cause dull iron by cooling.

Table II.

Report No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Diameter of cupola in inches	32	35	42	42	27	44	44	54	54	58	48	56	60	60	72
Area of cupola in square inches	804	962	1,386	1,386	572	1,521	1,521	2,290	2,290	2,642	1,810	2,463	2,828	2,828	4,072
Tuyere area in square inches	116	170	240	144	144	336	198	429	420	546	144	648	270	420	106
Ratio of tuyere area to cupola area	6.93	5.66	5.57	9.62	3.97	4.23	7.68	5.33	5.45	4.83	12.84	3.80	10.47	6.73	5.76
Blast pressure in ounces	16	16	12	8	9	9	13	13	14	16	8	16	8	8	13
Melt in pounds per square foot per minute	9.54	19.45	.....	18.19	15.12	20.87	15.22	18.87	22.64	18.14	10.08	21.60	18.80	18.40	20.06
Fuel bed above tuyeres, in inches	21	29.5	.....	15	20	33	25	24	32	24	25.5	40	30	22	26
Ratio of first charge	2.2	2.0	.....	2.3	2.0	2.3	1.0	2.1	3.0	3.0	3.7	3.0	3.5	3.8	2.8
Tuyeres from sand bed, in inches	11	7	12	11	12	12	10	8	14	16	14	25	2	12	24

There is one other condition which affects the melting ratio, and perhaps contributes more to the waste of fuel than any other. This is the height of tuyeres from the bottom. Also the construction of some cupolas having two rows of tuyeres. As we must consider the fuel below the tuyeres as only a foundation to keep the effective fuel at a proper height, and as these high tuyere cupolas have for their object the holding of metal in the bottom sufficient to pour large pieces, this provision would seem unnecessary.

As we will note, by referring to No. 13, the tuyeres in this 60-inch cupola are but two inches above the sand bottom, the iron was used to pour very light work and ran in a stream at the rate of 370 pounds per minute, filling a 2,000-pound ladle in a little over five minutes. It could be held for some time, retain its heat and be free from slag and dirt.

Further than what has been shown, we do not desire to make a comparison as to the melting ratio. Different kinds of work may be poured at different temperatures which fact should be taken into consideration in the study of the tables. We do not claim to be cupola experts but believe that you will find the figures given of interest to you.

PRODUCTION OF COPPER IN THE UNITED STATES.

The production of copper in the United States in 1906 was 917,620,000 pounds. Montana led all other states and territories with a production of 299,850,000 pounds, and Arizona was second with 263,200,000 pounds, while Michigan, popularly thought to be the greatest copper state, ranked third with 224,071,000. *The Engineering and Mining Journal,* from reports received from all of the refineries, placed the production of refined lead in 1906 at 415,656 short tons. This is an increase over the previous year of nearly 10,000 tons. The production is divided as follows: Total antimonial, 10,120 tons; soft, 118,000 tons; desilverized, 287,536 tons.

COPPER FOR THE FOUNDRY*

F. L. ANTISELL

COPPER for foundry purposes is required to possess certain properties, determined by the specific use for which it is intended, and that particular grade should be selected which will fill the requirements of the work in hand. To this end, the buyer should carefully consider the following points:

(1) Brand.
(2) Conductivity.
(3) Analysis.
(4) Shape.
(5) Appearance, i. e., color, pitch, etc.

The brand, which the writer considers as first in importance, conveys the greatest amount of information to the buyer of copper. It insures uniform quality aside from the chemical analysis (as various brands of copper vary somewhat in pitch, or say if you like, gases or oxides), which fact is of great practical advantage to the mixer of copper alloys, as the melting can be conducted largely by a pre-arranged schedule, for a reliable brand of copper can always be depended upon to run uniform, whereas, while the unknown or unbranded ingot may represent the very best grade of copper obtainable, it, on the other hand, may be only capable of producing a casting of inferior quality. Again, certain brands stand for a reputation that has required a vast amount of capital to create, and a large plant to produce. It is evident that a non-uniform brand of copper would jeopardize the business of the producing plant. To guard against this possibility, makers of various brands use every precaution to keep their products uniform in quality, it being not unusual to cast over 100,000 pounds of ingots at one charge, 12 ingots being cast simultaneously every 20 or 30 seconds. This large bath of copper is constantly under the inspection of metallurgists, chemists, and physical scientists. It can be said as an almost universal truth that writers on this subject invariably recommend the purchase of branded ingot copper only. However, with the advent of the foundry chemist, and with a good conductivity bridge, microscope and accessories, this situation will probably change to some degree in the future.

*Presented at the Philadelphia convention of the American Foundrymen's Association.

Conductivity.

Conductivity may be well considered second in importance only to the brand as it can be said within certain restrictions to be a measure of the ultimate quality of the metal. This test should be carefully conducted with an apparatus of modern design. For the foundryman the best results will be obtained by drawing into wire a specimen of the ingot and testing the hard drawn wire. The number of dies varies with the grade of copper. The same specimen can then be tested for tensile strength.

If the conductivity of hard drawn copper wire is 98.75 per cent (Mathiessen's standard), it will represent a conductivity of about 101 per cent if properly annealed. Should any impurities appear, the conductivity will be lower according to the specific resistance of the alloy, and quantity of various elements.

The accompany illustration shows graphically how the occurrence of even the most minute quantity of arsenic will vary the conductivity of copper. Thus, in annealed copper wire with a conductivity of 100 per cent we would hardly expect to find more than a trace of arsenic. Curves for the different elements show in an interesting manner the effect of impurities in copper. However, high conductivity in itself does not prove conclusively that between two specimens the higher in conductivity is the

more suitable for casting purposes. Within certain limits copper may contain impurities in an oxidized condition, thus reducing the resistance of the specimen as a copper alloy, but at the expense of its tensile strength whereas, on the other hand, the impurity occurring in a metallic state must necessarily reduce the conductivity, and in practically all cases increase the tensile strength. Thus the conductivity test is of more importance when considered in connection with a tensile test, and though various investigators do not agree in general on the point, it appears that as the rate of conductivity increases, the tensile strength decreases. The specimen for this test must necessarily therefore be treated for ultimate tensile strength only.

While copper refiners always give attention to the proper de-oxidizing of the metal there is almost always present a small quantity of copper oxide that does not appear to decrease either its conductivity or tensile strength.

Analysis.

In buying copper on analysis it is generally sufficient to specify the total copper contents. Copper running 99.90 per cent pure is suitable for the highest grade of copper alloy, and no distinction is necessary in specifying its origin as "Lake," "Electrolytic," etc. The percentage of copper contents may decrease steadily for different requirements according to the nature of the impurities. The principal impurities are arsenic, antimony, iron, sulphur, bismuth, selenium and tellurium.

Shape.

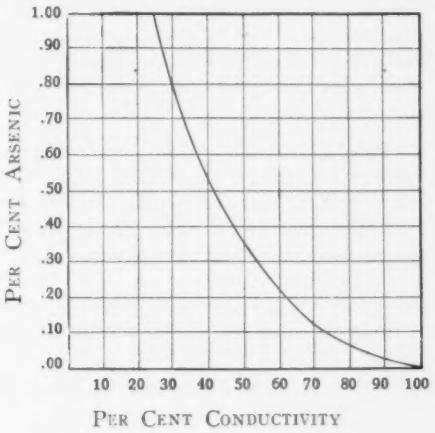
The shape of ingots varies with the individual tastes of refiners. In fact, it is not unusual for copper refiners producing two or more grades of ingots, to make them up into different shapes, thereby reducing the probability of mixing qualities. It would appear that a standard shape and weight of casting copper would be very desirable, and should receive some attention from the brass founder. The ingot has in many cases increased in thickness until its weight is close to 20 pounds, and often possesses but 2 heels, making it too heavy to be easily cut apart.

The principal shapes of casting copper in the market are:

1. The old fashioned three heeled ingot.
2. The newer form of 2 heeled.
3. The ingot bar.
4. The multiple ingot bar.
5. The slab.

These shapes all have advantages peculiar to themselves, but it would seem that the old fashioned ingot bar is more than holding its own, and is generally preferred by brass founders.

The ingot bar consists of a number of ingots cast continuously, end to end,



generally in groups of three three-heeled ingots, the ends being joined by a thin gate, forming an extra deep notch to facilitate detaching the individual ingots.

The multiple ingot bar is formed by several ingot bars cast side by side and connected at several points by gates. These bars must necessarily be cut apart before melting, and when adequate facilities are not at hand to separate them, the final cost is somewhat greater than for the ingot weighing say 20 pounds, although the latter has probably to stand a charge for cooperage. Furthermore, the ingot bar when cut apart presents sharp corners that have a tendency to abrade and shorten the life of the crucible.

To get economical results from the

slab, it is necessary to use a substantial shearing machine, capable of cutting the slab into pieces of proper size to be placed in the crucible, and the cost of this work must be charged against the shape as an offset to the saving in shipping expense.

Appearance.

If the author of the saying, "Appearances are deceiving," had in mind copper when making this remark, he could hardly have explained the situation more clearly. If there is one thing impossible, it is to judge the quality of copper by the color of its skin.

The terms, "rose red," "brassy," "black," mean nothing in regard to quality; the most beautiful rose colored ingot may contain ½ per cent of arsenic, while the blackest looking ingot ever made may be 99.99 fine. The various colors are due almost entirely to the temperature of the copper and pickle, when the casting leaves the mold. The pitch on the back of the ingot should be fairly flat with a uniform wrinkled top surface, and without sharp corners.

CHEMICAL PROPERTIES OF MALLEABLE CAST IRON.

(Continued from page 218)

Shrinkage cracks may in some cases be due to the high percentage of sulphur in the iron, and this may to some extent explain why some manufacturers cannot successfully produce castings from certain sections, while others have no difficulty in meeting the requirements.

Melting.

In my previous paper, I endeavored to describe the reverberatory furnace generally used by manufacturers of malleable cast iron, the manner of charging and finally the refining and the tapping. As in steel making the final product depends on the furnace work. The idea seems to prevail that the success or failure of malleable lies in the annealing of the castings.

The treatment of the iron in the furnace before it is poured is the feature of this process of first importance. Chemically combined carbon in cast iron is the fundamental principle for the making of malleable cast iron. Silicon is the element which governs the breaking up of this combination in the annealing process. Too high a percentage of silicon prevents the chemical combination of carbon and iron and too low a percentage of the carbon and silicon. Steel scrap is therefore used to lower the carbon if too high, as pig iron generally contains more silicon than is good for malleable castings. Fortunately, these two elements, carbon and silicon, can be burned out of the molten metal and this is facilitated by rabbling. The carbon combination is also affected by the temperature, and so sensitive is this combination that a sample dipped from the top of the bath may show perfect white iron, while a sample taken from the bottom at the same time, may show mottled iron, or even gray iron.

The colder iron is therefore used for castings with thin sections so as to receive the benefit of the chilling effect of the sand in the mold, while for heavy castings it is necessary to pour the metal as hot as possible.

Other Elements.

The other elements, manganese, phosphorus and sulphur, are not affected in the furnace, which in this respect is analogous with the acid open-hearth steel furnace. It is expected, however, that some sort of basic furnace will come in use which will overcome most of the difficulties now existing in the way of control of the several elements and thus advance the process.

During the past decade only one case of serious failure of a malleable cast iron section in a lot of heavy steel freight cars came to my notice and this exception, to my mind, rather proves the rule that we can rely on malleable cast iron as a material of construction in all cases where cast iron is too weak or too heavy, and cast steel unnecessarily strong and expensive.

THE AMERICAN BRASS FOUNDERS' ASSOCIATION

Organized at the Philadelphia Meeting of the A. F. A.—All Manufacturers of Products Made from Non-Ferrous Metals Eligible

THE American Brass Founders' Association was organized during the closing session of the American Foundrymen's Association in Philadelphia, on the morning of May 23. It is the intention to bring into this organization all industries whose products are made from non-ferrous metals. Those eligible to membership include not only proprietors but superintendents and foremen of brass foundries, and all connected with aluminum, copper and other works employing sheet metal, wire, or other forms of such metals apart from castings. Electroplating interests are likewise included. The committee oppointed on Tuesday with Dr. Moldenke as chairman reported a constitution and by-laws patterned closely after those of the American Foundrymen's Association. It was decided to call the new organization the American Brass Founders' Association, and while this name met with some objection from the aluminum and other interests, the difficulty of finding a name which would be all-inclusive was appreciated, as well as the fact that the brass founders had been the important factor in the promotion of the new association. The committee on nominations, composed of Palmer H. Langdon, of *Metal Industry*, New York; W. R. Webster, superintendent of the Bridgeport Brass Co., Bridgeport, Conn.; R. Marshall, of *Copper and Brass*, Detroit; A. A. Miller, of *The Iron Age*, Philadelphia; Chas. H. Proctor, of the F. H. Lovell Co., Arlington, N. J., and J. H. Webb, Elkhart, Ind., reported the following nominations, which were accepted without change:

President, Charles J. Caley, Russell & Erwin Mfg. Co., New Britain, Conn.

Secretary, Andrew M. Fairlie, Tennessee Copper Co., Copper Hill, Tenn.

Treasurer, J. H. Sheeler, the Sheeler-Hemsher Co., Philadelphia.

Vice presidents: For New England, W. R. Webster, Bridgeport Brass Co., Bridgeport, Conn., and W. S. Allen, Yale & Towne Mfg. Co., Stamford, Conn.; for New York and New Jersey, A. Bate, general superintendent Nathan Mfg. Co., New York City; Pennsylvania, Delaware, and Maryland, G. W. Wright, Reading Hardware Co., Reading, Pa.; central states, Wm. M. Corse, Detroit Lubricator Co., Detroit; western states, J. N. Gamble, general superintendent Western Tube Co., Kewanee, Ill.; southern states, Edro Richardson, the Edro Richardson Brass Co., Baltimore; Canada, left unfilled.

Brief remarks on the new association were made by Mr. Caley, Mr. Fairlie and Mr. Sheeler, and a number of applications for membership were taken. It was stated that the next meeting would be held at the same time and place as the American Foundrymen's Association, and the meeting was adjourned after voicing its thanks to Dr. Moldenke for his assistance in the work of organization.

Preliminary Meeting of Brass Interests.

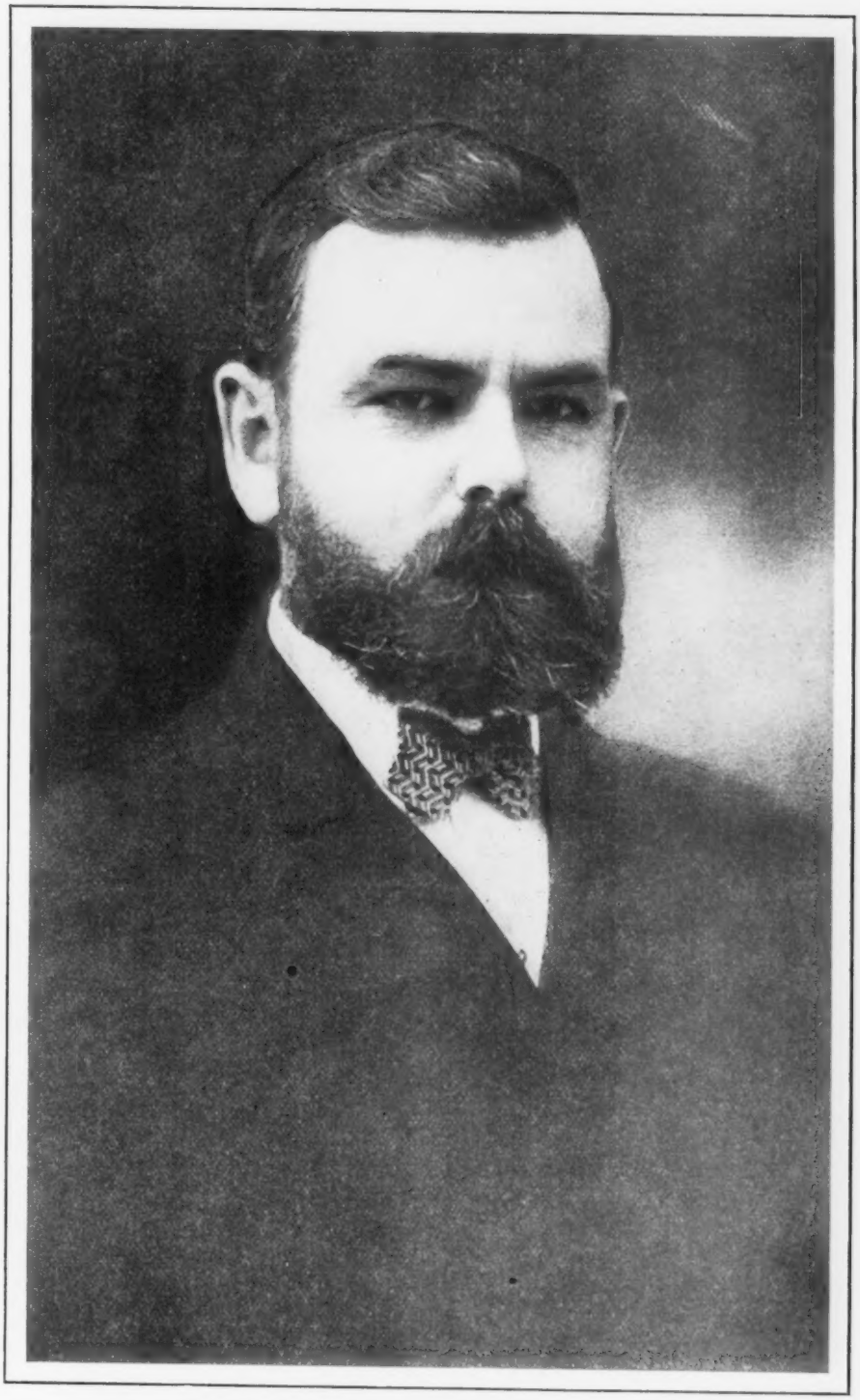
The preliminary meeting of those allied with the brass foundry interests to consider the advisability of or-

ganizing an association was held on Wednesday morning, May 22. It was presided over by Chas. J. Caley, New Britain, Conn., who made a brief address on the purpose of the promoters of the new organization. In answering the question who are eligible to membership he mentioned brass foundrymen, rolling mills, platers, supply men, electric workers, and those identified with the automobile industry, in fact, any one directly or indirectly connected with the working of the non-ferrous metals or their alloys. The speaker said that great things have been accomplished in the brass foundry in the past twenty years. He directed attention to the oil melting furnace, which he said has become a factor and is making rapid strides, although its field thus far has been limited to heavy castings. It has not as yet been able to replace the pit furnaces for light castings, plain and ornamental, such as are used in builders' hardware, saddlery, etc. He added that the molding machine has not met with as much success in the brass foundry as it should, owing in part to the character of the work and the cost of making and mounting patterns. The inventor has a problem here in designing a machine in which a standard frame may be used, the frame to be so arranged that by a simple method any gated or loose patterns may be attached quickly and accurately. The speaker said he knew of a dozen firms with thousands of patterns in their vaults, who would be only too glad to install molding machines in their brass foundries if they could obtain results without going to the expense of regating their patterns, as is necessary with most of the present molding machines.

Continuing, Mr. Caley said: "Handling, as I have been, hundreds of tons of brass and bronze wrought metal, and knowing the difficulties I have, due to defects in metal, I believe that the rolling mills have their own troubles, as well as the foundrymen and I believe in many ways they can be benefited by membership in our association. The automobile interests claim more than passing notice, on account of the many intricate castings employed, castings that must be accurate and so constructed that they will withstand the tensional and torsional strains to which they are subjected. To accomplish the results desired it is necessary that the foundryman making such castings has in his employ men with a thorough knowledge of the foundry business and its requirements, men familiar

CHARLES J. CALEY

CHARLES J. CALEY, who was elected first president of the American Brass Founders' Association, was born in Jersey City in 1863, but went to Norwich with his parents at an early age and secured his first position with the Norwich Lock Shop. He remained there eleven years and later accepted a position with the Sargent Co., New Haven, Conn., as foreman of the padlock department. He held this position for five years, when he left to enter the employ of Yale & Towne, Stamford, Conn. In addition to occupying the position of contractor for this concern, he was made general foreman for the lock and hardware departments. He remained with this company for a period of nine years and re-entered the employ of the Sargent Co., in the capacity of contractor in the hardware department. He left this latter position to go to New Britain, Conn., as superintendent of the Russell & Erwin Mfg. Co., of which he was made general manager in 1906. Mr. Caley is a member of the American Society of Mechanical Engineers, and one of the district vice presidents of the American Foundrymen's Association. He is also vice president of the Russwin Land Corporation, of New Britain, a trustee of the New Britain lodge of Elks, and a past master of the Ancient Order of United Workmen. He has been remarkably successful as an inventor, and in the past few years has received letters patent for nearly forty inventions along lines covered by his business.



CHARLES J. CALEY
President of the American Brass Founders' Association

with coremaking as well as the mixing and melting of metals required in automobile work. Plumbing and steam fitting interests certainly come in for their share of our attention, as they have made wonderful strides in the past twenty years, when we consider the old plumbing and the up-to-date open plumbing, the making of which has caused a revolution in the art of making light, durable castings. The same is true of steam fittings, as many of the valves of today are cored, where years ago they were bored. Steam pressure has been raised without showing any bad effect, which would go to prove that an advance has been made in the manufacture of metals to the extent that the cored valve of today is lighter by one-third than the valve of years ago."

Mr. Caley was followed by Paul Kreutzpointner, Altoona, Pa.; Hugh McPhee, Bridgeport, Conn.; Edro Richardson, Baltimore, Md.; W. H. Parry, Brooklyn, N. Y.; J. M. Gamble, Kewanee, Ill.; J. H. Sheeler, Philadelphia; Chas. Thomann, Crosby Steam Gauge & Valve Co., Boston; G. W. Wright, Reading, Pa.; and Messrs. Thompson and Bellows, Bridgeport, Conn. All were of the opinion that an association devoted to brass founding and kindred interests would have an important field of endeavor and would result in great good to all connected with these industries.

The study of brass mixtures, it was stated, would in itself prove an important line of inquiry for the new association. The preparation of molds, particularly their gating, and the pouring of the metal of proper temperatures are matters which might be investigated and discussed with profit. Papers were read by Andrew M. Fairlie, Copper Hill, Tenn., on "Science Applied to the Brass Industry," and by Chas. H. Proctor, Arlington, N. J., on "Electro-deposition of Brass." The following papers were read by title: "A Plea for Healthful Conditions in the Brass Industry," by W. B. Snow, Hyde Park, Mass.; "Notes on Brass Castings," by C. E. Johnson, Dorchester, Mass.; "Copper for the Brass Foundry," by F. L. Antisell, Perth Amboy, N. J.; and "A Few Denatured Brass Foundry Notes," by Wm. H. Parry, Brooklyn, N. Y.

AUTOMATIC POLISHING*

JONAS A. PARKER

ATTEMPTS at automatic polishing or buffing extend back over a period of many years, but only during the past few years has it taken on a practical form and met with such popular favor as to assure its ultimate success, both as regards economy and improved health conditions. Mechanical polishing will continue to advance along with other metal working machinery just in proportion as it deserves. The finest machine shop equipment, manned and supervised as some buff-rooms now are, would produce results disappointing to a firm's manager, yet we do not attribute many past failures of mechanical polishing to the ignorance of the operatives alone.

Automatic polishing has been held back because of a crazy endeavor of inventors to construct a machine that would polish anything from a button to a cook stove. Patent attorneys have feasted, experimental machinists have benefited and the junk dealer has smiled as he has seen some dear creation relegated to the scrap heap. Experimenters at last changed their ideas and they built a machine to polish buttons and nothing else. The same in a measure is true of cook stoves and heaters.

After many discouragements and trials a machine is now manufactured

*Presented at the Philadelphia convention of the American Foundrymen's Association.

and in use in many of the larger stove works in which you place castings similar in form and outline, and their polishing is rapidly accomplished. No attempt is made to polish all the parts on this one machine; other parts, the rings for instance, receive attention from a machine bearing no point of resemblance to the first machine. I am reliably informed by a large manufacturer of stoves that they simply could not complete their orders had they to depend on hand polishing. The same may be said of tubing used in gas ranges, bathrooms, chandelier fixtures and bedstead work.

Later automatic machines for polishing hollow-ware were called for and the call was not in vain. After experiments extending over a period of three years, machines are now operating in many large factories not only doing the work at a great saving in cost, but doing better work than can be obtained by hand buffing. Such inroads have been made in the polishing field by mechanical polishing that in some instances hollow-ware factories have dispensed with one-half their former polishing force and have secured an increased output. Owing to similarity of sizes and shapes hollow-ware has proven an advantageous field for automatic polishing and manufacturers have not been slow to avail themselves of the advantage afforded. Lamps, particularly those of the automobile variety, search lights and headlight reflectors are also included in this line.

Reliability.

Another point not to be lost sight of in an investigation of mechanical polishing is the reliability of the machine. They do not absent themselves from the factory as is sometimes the case of hand polishers, thus decreasing the output during a rush season. They serve as a reminder to their operator that they are there to do the work, and being simple of operation no time is lost owing to absence of regular operator, as another without skilled training can quickly operate them at their full capacity.

Ragged irregular shapes cannot be successfully polished by machines, but while waiting the coming of the electrician or chemist who shall by invention obliterate all remainder of the death-dealing buff wheel, is it not incumbent upon you as employers to investigate claims made for ameliorating this serious condition?

You ask if machine polishing can be adapted to your line of work and how it will benefit the polisher?

The answer is, first by releasing a large percentage of those now employed over the disease breeding buff wheels, and forcing them, if necessary, to other trades fit for man.

Second, in removing those who are needed to operate machines, away from the seat of trouble to a natural position. Improving the condition has improved the man and he leaves the factory after his day's work with the same feeling of satisfaction as the machinist or the office clerk.

In conclusion, then, I invite you to investigate automatic polishing. I believe it worthy of your encouragement both from a financial and a humanitarian standpoint.

THE OIL FURNACE VS. THE SHEELER-HEMSHER IMPROVED CRUCIBLE FURNACE*

W. H. KANE

THE advances made during the past few years by designers and builders of various styles of melting furnaces for brass and other metals have been brought to the attention of the trade from time to time.

In the February edition of a trade

*Read before the Philadelphia Foundrymen's Association.

magazine there appeared an article on the furnace question that intimated that any brass foundryman who did not use an oil furnace was a blockhead. The writer of this article may be right, but only from his own point of view, which reminds me of the story of an Irishman who went into a hat store to buy a hat. He was met by a pompous looking sort of a clerk, who asked him what he could do for him. The Irishman replied, "An' begorrah, what does y'se make in here?" "Blockheads, me lad, blockheads." "Ah, y'se do, dues y'se; well, y'se must do a damn good business, as I see y'se only have one left."

The development of the Sheeler-Hemsher furnace was entirely due to the force of necessity. In regular practice we had been using in our foundry, furnaces of the natural draft type, having an 80-foot stack, 3 feet in diameter, which should have given enough draft, and did at times, but right here is where the difficulty was experienced; the draft could not be depended upon, and heats were in some cases delayed for hours, which any one will admit, is a first-class means of eating up profits. We found a loss in oxidation as high as 7 per cent on red metal alone, and at times it was necessary to have our furnacemen begin as early as 5:30 in the morning, in order to have the metal ready for the first pouring.

Considerable thought was given to the development of a furnace which could be depended upon, and which would be as simple as possible, one without complicated mechanical features, and one that could be built at minimum cost, with low fuel expense, and at a reduction in loss by oxidation, the result being the Sheeler-Hemsher forced draft crucible furnace, using a combination of coal and coke for fuel. This type of furnace has been in successful operation in our own foundry, as well as in a number of other foundries for several years past, the J. W. Paxson Co. being the sole agents and manufacturers.

Sheeler-Hemsher Furnace.

In this furnace a number of the old natural draft furnace principles have been retained, while a number of new features have been added the result being a furnace without any unnecessary mechanical accessories which often look well, argue well, but fail to produce the desired result. The reduction of fuel costs, the saving of time in melting and the low percentage of loss by oxidation, have been proven by actual practice, and are the subject for no further argument. The contention of many that black lead crucibles suffer greatly under forced draft does not seem to be borne out by our experience with this furnace. In fact, we have been able to get almost regularly from 30 to 35 heats apiece from several of the leading makes of crucibles.

Construction.

The Sheeler-Hemsher furnace can be built to accommodate almost any size crucible; those in general service take in a No. 70 without difficulty. This size furnace measures approximately 27 inches in height and consists of two ⅜-inch boiler iron shells, 18 and nine inches in height respectively, and 26 inches in diameter, bolted together, making two sections and lined with fire brick placed on end. The upper section is made so that it can readily be removed from the lower one by a T iron connection, that serves to hold the fire brick lining of the shell in position, as well as forming a guide and clamp to hold the lower section in position, which rests directly on the ash pit or air chamber. The advantage gained in making this furnace in two sections is that it permits of repairs to either the upper or lower sections independently without the necessity of relining the entire furnace. The ability to do this as often as the lining of the lower fire box section cuts out can be appreciated. It not only reduces the costs of repairs, but it enables one to reduce the area of the

fire box, due to the cutting of the lining.

Air Chamber.

The ash pit or air chamber of the furnace is rectangular in shape, 39 inches long, 27 inches wide, and 12 inches deep, with the usual door for cleaning out the ashes, etc., mudded up in the regular manner when the furnace is in operation. The top of the ash pit consists of a cast iron plate with a raised rim which holds the furnace in position. The fire box extends about eight inches in front of the furnace, and the inlet of the blast into the fire box is through a 3-inch pipe, located in the upper portion of this extended section, the air blowing directly downward into the pit. The grate bars are one inch square and are carried in a sling just under the fire box. The furnace tops or covers are cast iron and semi-circular in shape, made in two sections, with an opening in the center 11 inches in diameter, in order to hold a worn out crucible, with the bottom removed, so as to act as a funnel in charging, and when the funnel is not in use, it is covered in turn by a small separate cast iron cover that can be easily shifted and allow the melter to get at the pot for stirring, etc., without removing the entire cover.

Blast Pressure.

The blast used in connection with a Sheeler-Hemsher furnace should be at a pressure of from one to one and one-half ounces. In our foundry, where a battery of eight furnaces is installed, the pressure is supplied by a No. ½ Baker pressure blower, giving 13 ounces pressure when all the gates are closed A six-inch blast main carries the air to the furnace and the average pressure per furnace is about one ounce.

Low Melting Cost Records.

Some records as to the working and fuel cost on these furnaces, made in our own plant, follow:

Recently 200 pounds of copper, in the shape of sheet clippings and chunks were run down and poured into castings in 60 minutes. A No. 70 crucible was used and the fuel consisted of 36 pounds of coal and 46 pounds of coke, the fuel cost per 100 pounds of metal being 11 cents.

One hundred and eighty pounds of red brass scrap were run down, ready for pouring in 45 minutes, the fuel consumption being 24 pounds of coal and 24 pounds of coke, the cost for fuel being 8 1-3 cents per 100 pounds of metal.

One hundred and eighty pounds of yellow brass punchings were melted ready for pouring in 35 minutes, using 20 pounds of coal and 24 pounds of coke, at a cost of 6 2-3 cents per 100 pounds of metal.

As an experiment 180 pounds of pig iron, broken in small pieces, were run down in this furnace in one and three-quarter hours, pouring a clean and perfect casting. No fuel account was kept against this heat, as it was not the question of economy, but of the ability of the furnace to develop the necessary heat to melt the charge in a reasonable time.

In all the above tests the loss of metal by oxidation was extremely low. In three separate tests in running down red brass turnings or chips the loss in each case was 1½ per cent. In running down copper ingots we were unable to determine any loss.

In running down copper gates and wire the loss was 10 ounces per 100 pounds, and part of this was, no doubt, sand that adhered to the gates.

One hundred pounds of yellow brass ingot, gates, etc., were run down in 40 minutes with a loss of ¾ pound, using 24 pounds of coke and 20 pounds of coal.

NOTES ON BRONZE CASTINGS.*

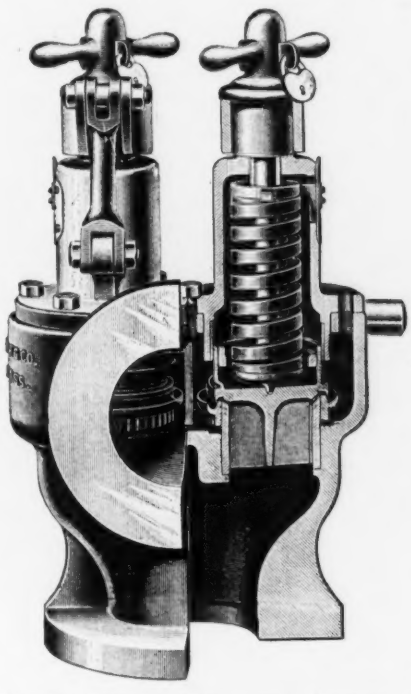
C. E. JOHNSON

In connection with the new Association of the Brass and Bronze Founders to be formed, I might say that a gathering of founders in these lines is very much needed, for there are so many questions

*Presented at the Philadelphia convention of the American Foundrymen's Association.

to be solved that only interchange of thought and experience will save loss and annoyance and improve the industry as a whole.

While the cry of the finishing room is always directed against the foundry, in the case of defects, yet the difficulties which beset the foreman there are very troublesome. I give a few instances to show the need of further investigation



VALVE SECTION SHOWING HEIGHT OF NICKEL SEAT FROM BODY

along the lines of the metal itself and the manner of molding and pouring.

In casting very heavy valves for U. S. battleships, the unequal expansion of the solid nickel seat placed into the bronze valve caused much trouble, as the nickel seat would get out of round under pressure. The nickel was 4½ inches by 6 inches, and when finished was tested at 175 pounds pressure. It was then placed into the valve and tested at 200 pounds pressure. The illustration shows how high the nickel seat stands from the body.

After trying various alloys to replace the nickel, with no better success, the seats were reground again and again, taking them off each time, until finally after half a dozen trials the valves were made tight. The best results were obtained with the valve body of a bronze with no zinc, and solid nickel seats.

Again we had to make some castings weighing 200 pounds each, about 2 feet long, one foot in diameter, and ½ inch in thickness all over. There would always be trouble with leaks at the flanges. Whether we cast them flat or on end with flange down, the result was always the same when tested under 500 pounds pressure. Finally, we cast the bodies with flanges up, and got perfect results. This shows how the method of molding has much to do with the result. The metal was cast as hot as possible without burning.

A NEW TROPENAS STEEL FOUNDRY.

A. Tropenas, Paris, France, on his recent trip to this country, completed arrangements for the incorporation in Delaware of the Tropenas Steel Co., with $500,000 common stock and $250,000 preferred stock. A tract of about 90 acres, with a frontage of 1,200 feet on the Delaware river, has been purchased in New Castle, Del. A steel foundry will be erected at once, and will be equipped with two 2-ton Tropenas converters, for the production of a general line of small castings. The complete personnel of the company is not yet announced. The original Tropenas patents have expired, but Mr. Tropenas has patents pending on a converter of about ½-ton capacity, designed to meet the demand for a steel casting plant involving a comparatively small investment, which can be operated as an accessory to a gray iron or malleable foundry or machine shop.

MAKING VANADIUM STEEL.

The United States Steel Co., Canton, O., is now making vanadium steel for commercial purposes in its 50-ton basic furnaces. Recently the company made a heat of about 30 tons.

EXPOSITION OF FOUNDRY SUPPLIES AND EQUIPMENT

Held by the Foundry Supply Association at Philadelphia—Greatest Exhibit of Its Kind—More than Seventy Manufacturers Represented

FROM the morning of May 20, until Friday night the Second Regiment Armory, Philadelphia, was converted into a model foundry, where practical demonstrations were made of the most modern appliances for foundry work. Molds of the most intricate sections were made on power machines and cores were dried in ovens installed in the armory.

Two large sand conveyors and mixers were shown in operation and the exhibits of sand shakers included types both air and electrically driven. Heavy power machines and brass furnaces were operated in a tent, erected in a lot adjoining the armory, and the display of French machines made by Ph. Bonvillain & E. Ronceray, Paris, attracted unusual attention. The exhibitors were unanimous in proclaiming this feature a pronounced success, many of them having sold sufficient equipment to more than defray their expenses. One builder of molding machines reported sales aggregating $6,000, while another manufacturer of foundry equipment disposed of three large cupolas. In the line of smaller supplies, the sales were heavy and the indications are that the next show of the Foundry Supply Association will be on a larger scale than heretofore attempted. Including the displays grouped in the various booths more than 70 concerns were represented.

Meeting of the Foundry Supply Association.

At the annual meeting of the Foundry Supply Association, held in the assembly room of the Armory on Friday morning, May 24, reports were presented by Secretary H. M. Lane, and J. S. McCormick, treasurer. The total receipts for the year amounted to $5,948.50, in addition to which there was due from members, $1,445, making a total of $7,393.50. The expenses of the exhibit, it was stated, would approximate $6,500. From the treasurer's report it would seem that there will be a balance of something over $1,000 after the expenses of the meeting are paid. The increase in membership during the year was remarkable, 99 concerns now being enrolled. For his untiring efforts in behalf of the association, Secretary H. M. Lane was tendered a hearty vote of thanks and his salary was increased from $500 to $1,000 a year.

Election of Officers.

The nominating committee, consisting of T. E. Malone, H. Y. Seidel, E. J. Woodison, C. S. MacNeal and A. O. Backert, then presented its report, and the following officers were unanimously elected: E. H. Mumford, the E. H. Mumford Co., Philadelphia, president; W. P. Shepard, Rogers, Brown & Co., Buffalo, first vice president; W. S. Quigley, Rockwell Engineering Co., New York, second vice president; H. R. Atwater, Osborn Mfg. Co., Cleveland, third vice president; William Chambers, Garden City Sand Co., Chicago, fourth vice president; H. M. Lane, Cleveland, secretary, and J. S. McCormick, J. S. McCormick Co., Pittsburg, treasurer. U. E. Kanavel, Interstate Sand Co., Cleveland, and E. J. Woodison, Detroit

GENERAL VIEW OF THE EXPOSITION OF FOUNDRY EQUIPMENT AND SUPPLIES IN THE SECOND REGIMENT ARMORY

Foundry Supply Co., Detroit, were elected trustees to replace the two trustees whose terms expired with this meeting. The number of trustees was also increased from six to nine, and W. J. Hamilton, Hamilton Facing Mill Co., Hamilton, Ont., was elected to a three-year term and F. N. Perkins, Arcade Mfg. Co., Freeport, Ill., and George Rayner, Carborundum Co., Niagara Falls, N. Y., were elected for two years.

The question of permitting manufacturers and supply dealers not members of the association to distribute printed matter and souvenirs in the convention hall was discussed at some length and it was decided to leave this matter entirely in the hands of the secretary. Other details, including the charging of a nominal admission fee to those not members of the American Foundrymen's Association and the allied organizations were also considered and left in the hands of the executive committee.

Representatives of the cities of Toronto and Niagara Falls extended invitations to the association to meet next year in their respective cities. The use of a hall at Niagara Falls absolutely free of charge was offered the association and a similar proposition was made by the city of Toronto. Inasmuch as the American Foundrymen's Association, selects the place of meeting, no action was taken beyond thanking the two cities for their kind invitations.

EDGAR H. MUMFORD

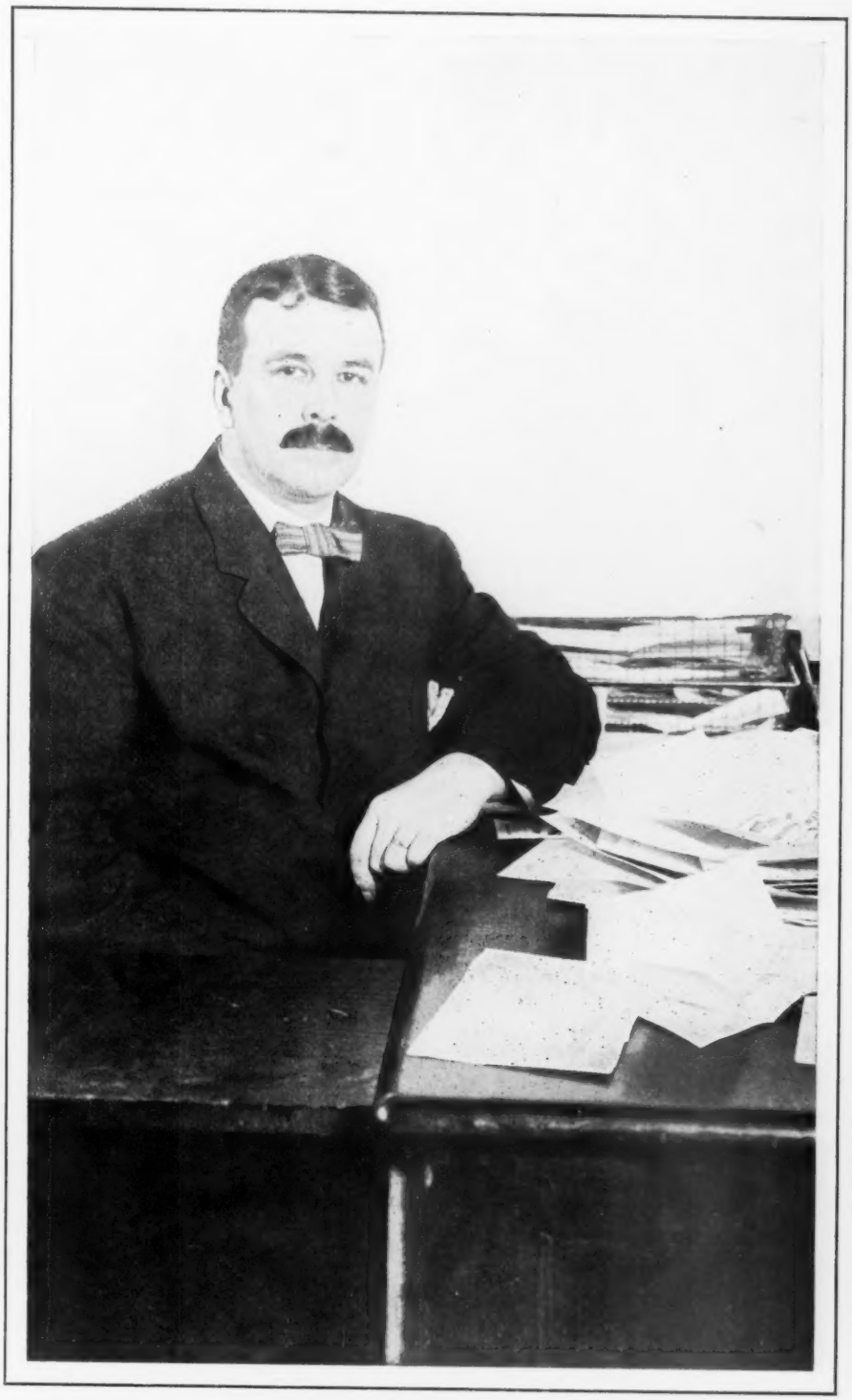
EDGAR H. MUMFORD, recently elected president of the Foundry Supply Association, is a well known business man of Philadelphia, where he is president and treasurer of the E. H. Mumford Co. Born at Groton, Mass., in 1862, the son of Rev. Thomas James Mumford, a Unitarian clergyman, Mr. Mumford was fitted for Harvard university at the Roxbury Latin school. Instead of entering Harvard, he attended the Massachusetts Institute of Technology, where he graduated in 1886 in the department of mechanical engineering. In September of that year he entered the service of the Union Pacific railroad at Omaha and served three years in the motive power department. After promotion to the position of master mechanic of the Leavenworth division he left railroading permanently in the fall of 1889 to become superintendent of the Russel Wheel & Foundry Co., Detroit. After three years in this position he returned to the east, where he became associated with Henry R. Worthington, Inc., in Brooklyn. There he was shortly put in charge of the new foundry built by this company at Elizabethport, N. J. Within a year he was placed in charge of the pressure pump department, leaving this position to become manager of the New York office of Bement, Miles & Co., Philadelphia, remaining in this position until the summer of 1895, when he decided to strike out in business for himself. In company with Harris Tabor and Angus Sinclair, Mr. Mumford purchased the business of the Tabor Mfg. Co. from Manning, Maxwell & Moore, and remained with it as secretary for ten years. In 1900 the company's plant was removed to Philadelphia, and in 1905 Mr. Mumford resigned from it to form the E. H. Mumford Co., builder of molding machines. From this brief sketch it will be seen that the new president of the Foundry Supply Association, of which he was one of the organizers, is a man of wide experience in the foundry trade. He is a member of the American Society of Mechanical Engineers, the Engineers' Club of New York, and the Art Club of Philadelphia.

PERSONAL.

E. A. Moore, president of the American Coke & Gas Construction Co., has been elected president of the Wilbraham-Green Blower Co., Philadelphia, to succeed J. S. Wilbraham, who has retired on account of ill health.

Lewis G. Blunt, formerly foundry superintendent of the Ferro Machine & Foundry Co., Cleveland, has accepted a similar position with the Platt Iron Works, Dayton, O.

W. H. Von Mengerinhausen has been elected general manager of the Catasauqua Castings Co., Catasauqua, Pa.



EDGAR H. MUMFORD
President of the Foundry Supply Association

EXPRESSIONS FROM EXHIBITORS WHO UNANIMOUSLY PROCLAIMED THE SHOW A SUCCESS

I. N. DAVIS, Monarch Emery & Corundum Wheel Co., Camden, N. J. "The exhibition has been both creditable and successful. Never before did I see such interest shown at an affair of this kind, or such good feeling exist. From a business standpoint, inquiry has been surprisingly good."

Jos. H. Dalton, Macphail Flask & Machine Co., Chicago. "Full credit must be given the Foundry Supply Association for the complete and unprecedented success of this exposition. Great interest has been manifested in the equipment shown, and so far as business is concerned, we have been well repaid for our efforts in signed orders alone, with a mass of inquiry to follow up. A general display such as this serves to waken up the foundrymen to their opportunities."

R. O. Lovell, Oliver Machinery Co., Grand Rapids, Mich. "Throughout the exhibition particular pains were taken by exhibitors to demonstrate their machines to interested parties in the proper way. The result has been that not only are exhibitors pleased, but visitors have seen and learned a great deal. No doubt this is the best and most complete exposition ever held by foundry interests."

A. E. Hoermann, New York. "Both in results and in interest shown in the exhibits the convention has been far better than anticipated. Our sand blast machines attracted large crowds to our booth, and nine-tenths of the visitors were interested. We have taken several orders here and expect a great deal more business to develop from the exposition. Next year we will be there with double space."

H. P. Raper, A. Buch's Sons, Elizabethtown, Pa. "I am sure that this exposition has advanced the sale of our gravity molding machines at least five years. We never had an exhibit elsewhere which excited so much interest as this. We expected no business here, but did considerable, and I have a pile of cards six inches high as prospects to work on. It was a wonderful success."

W. W. Sly, W. W. Sly Mfg. Co., Cleveland. "Our line is such that we cannot take orders here, but we are known and we use this opportunity to let people know we are still on top of the earth. I wish more of our competitors had been here. The possibilities of such an exposition for a comparison of machines are great. We sold a number of core sand cleaners and are mighty well satisfied with results."

Kenneth Falconer, Gunn, Richards & Co., New York. "Though I cannot see any definite results, I am convinced that it is the best advertising we have ever done. It has been a strenuous affair. Our booth was thrown open as a resting place, with stenographic facilities, and I was surprised at the large number of Canadians among the visitors availing themselves of its privileges."

Harris Tabor, Tabor Mfg. Co., Philadelphia. "It was the best show of its kind ever held. We have made numerous sales and our visitors have been of a kind we will hear from later on. The entertainment features of the convention are deserving of praise."

Stanley Doggett, New York. "We have been well repaid and indications are that the indirect returns will still further compensate us for the time and expense involved. Both attendance and exhibits exceeded expectations. My only suggestion is that some way be devised of keeping out uninterested and undesirable persons."

SHAKERS
40 MOLDS AN HOUR ON THE MODERN MOLDING MACHINE.
Arcade Manufacturing Company.
FREEPORT ILLINOIS.
IN OUR FOUNDRY
A MAN AND A "MODERN"
AVERAGED 42 MOLDS AN HOUR
EVERY WORK DAY FOR 30 DAYS
AND IS STILL DOING IT.
THESE ARE THE CASES

EXHIBIT—ARCADE MFG. CO.

Chas. J. Goehringer, Foundry Specialty Co., Cincinnati. "We would not miss another exposition if the time and expense outlay were ten times as great. We are going back home with plenty of orders and prospects."

J. M. Betton, C. Drucklieb, New York. "In results the exhibition has been highly successful. We have done some business direct, and are going to do a great deal more, as our inquiries are all from people in actual need of sand blast apparatus."

E. Bertram Pike, Cortland Corundum Wheel Co., Cortland, N. Y. "The affair has been a wonderful success and cannot be compared with last year's exhibition. We have been surprised at the number of orders taken. The entertainment features have been fine and visitors were of a good class, with authority. More people visited our booth in one day here than during the entire Cleveland show."

D. S. Robeson, Camden, N. J. "The exhibition has done us a remarkable amount of good, both from an advertising standpoint and in direct orders. The average of the visitors was unusually high, and we are going away with a great deal of prospective business."

H. E. Mills, C. E. Mills Oil Co., Syracuse, N. Y. "The show was the biggest and grandest ever held. Every man with a display has been amply repaid. The only criticism which might be offered is that workmen in the local shops evidently did not know they could get in. We ought to have those of the better class."

B. Remmers, Kerr Turbine Co., Wellsville, N. Y. "The exposition has served to advance foundry standards. Several molders visiting our booth said they had learned a great deal from the exhibits. We are well satisfied with the result, as we have booked many inquiries, several of which are really requests for estimates."

H. G. Boughton, Standard Sand & Machine Co., Cleveland. "We are going to get a lot of business out of our exhibit. The attendance was large and of good quality, as the visitors were here for instruction. We are now putting another story on our plant, but if business develops as our

EXHIBIT—BERKSHIRE MFG. CO.

inquiries indicate, we will have to add still another."

Edward J. Etting, Philadelphia. "We sold the cupola on exhibit, have nine to quote on, and prospects are favorable for other orders. I do not see how anything could have been more successful. Many new exhibitors were here and they were materially assisted by the spirit of cooperation prevailing."

A. M. Guenther, Goldschmidt Thermit Co., New York. "It was a thorough success. Our work was chiefly of a missionary character, but we were well repaid. More intelligent, progressive foundrymen were here than at any former occasion of this kind."

H. B. Gaylord, B. F. Sturtevant Co., Hyde Park, Mass. "Our exhibition has developed a lot of healthy inquiry and we are well satisfied. Visitors seemed to understand what they were looking for, and to comprehend demonstrations. Our high pressure blower attracted much attention and we have taken a number of inquiries for new plants."

S. F. Smyth, Smyth, Swoboda & Co., New York. "The exhibition was first rate in every respect. It was the best convention we have ever attended and from an advertising standpoint has done us much good."

J. S. McCormick, J. S. McCormick Co., Pittsburg. "We have the satisfaction of knowing that this was one of the best and ultimately the most profitable expositions ever held. We have sold one or more of every machine exhibited. It has been an educational affair, with a general good time provided through the hospitality of the Philadelphia foundrymen."

A. W. Weigel, Killing Molding Machine Co., Davenport, Ia. "We have had the best results ever. Put it down as strong as you like. We are sold way ahead, but had to take some orders because they were forced on us."

H. R. Atwater, Osborn Mfg. Co., Cleveland. "The success of this convention went beyond all expectations. Have made a considerable number of actual sales in addition to developing a large number of inquiries. It enabled us to get acquainted with a large number of foundrymen that we

EXHIBITS—PH. BONVILLAIN & E. RONCERAY AND HERMAN PNEUMATIC MACHINE CO.

have not met before, and good business from these new acquaintances is already in sight."

R. H. York, Berkshire Mfg. Co., Cleveland. "This exposition surpassed all expectations and has been of great mutual benefit to the foundry supply men, as well as the foundrymen. Actual sales far exceed the total expenses of the convention and exhibit and if we get 20 per cent of the business promised we will be kept very busy for the next nine months."

J. W. Campbell, Cleveland Wire Spring Co., Cleveland. "This exposition has been a remarkable success. We have been amply repaid from every point of view."

Geo. H. Wadsworth, Falls Rivet & Machine Co., Cuyahoga Falls, O. "This exposition was the best ever. Have made a number of actual sales and have developed enough live prospects to repay the expenses of the convention three times over."

F. H. Chamberlin, J. D. Smith Foundry Supply Co., Cleveland. "The exposition is way above expectations. We did not expect to do any actual business, but have sold considerable equipment and have made a large number of new acquaintances. Courtesies shown and entertainment furnished by the local association were complete as well as unique. Our exhibit at this convention has demonstrated that all thoughtful foundrymen who are looking for the best in foundry equipment are endeavoring to arrange their time for buying so as to see first all the very latest and best equipment at this meeting."

E. J. Woodison, Detroit Foundry Supply Co., Detroit. "There is no doubt in our minds that the exhibition feature in conjunction with the A. F. A. is a fixture that has come to stay. Our exhibit at Cleveland resulted in the sale of material at a profit greater than our entire expense, and the same statement applies to our exhibit in Philadelphia. The A. F. A.'s deciding on Toronto as the next city in which to hold a convention is certainly complimentary to our Canadian cousins, and their representation at the convention entitles them to it. Much credit is due THE FOUNDRY and *The Iron Trade Review*

EXHIBIT—CAMDEN COKE CO.

for advertising the convention so extensively."

H. T. Frauenheim, Herman Pneumatic Machine Co., Zelienople, Pa. "From the standpoint of display we found in the Philadelphia convention everything a foreman would want to see. It seems that the greatest interest was displayed in the various types of molding machines, and the large number exhibited clearly showed what progress had been made in this line since the last convention. From a business standpoint the orders received since the last convention more than justify the outlay. There has not only been a large inquiry, but actual business has been done, as we sold every machine exhibited."

Mr. Robiczek, Arthur Koppel Co., New York. "Our experience at the convention has proved to us that any interest allied with the foundry trade cannot afford not to have an exhibit at the convention of the American Foundrymen's Association. Our display attracted considerable attention, and we received a large number of inquiries and feel well satisfied with the results of the meeting."

THE EXHIBITS

INCLUDING the displays grouped in the various booths, more than 70 concerns were represented, as follows:

ADDRESSOGRAPH CO., New York.—Display of rapid addressing machines.

AMERICAN FERROFIX BRAZING CO., Philadelphia.—The brazing of metals was shown by practical demonstrations, with the use of either illuminating gas or oil as fuel.

ARCADE MFG. CO., Freeport, Ill.—Three molding machines, two No. 1 and one No. 2, equipped with different styles of pattern plates, showing the different grades of work that these machines can handle successfully. This display also included an assortment of the different classes of work which have been turned out on these machines.

BERKSHIRE MFG. CO., Cleveland.—Two standard size Berkshire molding machines were shown in operation, molding radiators, hot water heaters, soil pipe, and fittings, and one freak plate was used containing a variety of patterns. Sand elevators, revolving screens, flasks, etc., were also shown.

BONVILLAIN, PH., & E. RONCERAY, Paris.—One R-3 swinging Universal machine; one R-3 swinging Universal hydraulic ma-

CHICAGO PNEUMATIC TOOL CO.
PNEUMATIC TOOLS. ELECTRIC DRILLS. AIR COMPRESSERS
MAIN OFFICE CHICAGO 820 ARCH ST. PHILA. PA. 95 LIBERTY ST. NEW YORK
HENRY
FOUNDRY
PYROMETERS

EXHIBIT—CHICAGO PNEUMATIC TOOL CO.

chine; one sand distributor; hydraulic accumulator, pump, templet cutting machine, and one A-6 molding machine.

BORGNER, CYRUS, Philadelphia.—This exhibit contained a full line of fire brick, clay retorts, and other refractory supplies for foundry use.

BROWN, EDWARD, & SON, Philadelphia.—Complete line of pyrometers for foundry use.

BUCH'S, A., SONS, Elizabethtown, Pa.—Catalogs and printed matter describing the gravity molding machines manufactured by the Mitchell-Parks Mfg. Co., St. Louis, were distributed at this booth. This company represents the Mitchell-Parks Mfg. Co. in the east.

CAMDEN COKE CO., Philadelphia.—Exhibit of coke manufactured by the Otto Hoffman by-product system.

CHICAGO PNEUMATIC TOOL CO., Chicago.—Full line of pneumatic riveters, drills, chippers, grinders, rammers, sand shakers, hoists, and air compressors, for foundry use.

CLEVELAND WIRE SPRING CO., Cleveland.—Full line of foundry barrels and steel foundry boxes.

COOPER-HEWITT ELECTRIC CO., New York.—Cooper-Hewitt light installation in the armory.

CORTLAND CORUNDUM WHEEL CO., Cortland, N. Y.—Corundum grinding wheels, and bricks. Two motor-driven grinders, fitted with suitable wheels for grinding cast iron and large and small tools and saws.

CRAMP, WILLIAM, SHIP & ENGINE BUILDING CO., Philadelphia.—Parsons' white brass and manganese bronze and a display of castings and ingot molds.

DAYTON PNEUMATIC TOOL CO., Dayton, O.—Pneumatic hammers, riveters, chippers, etc.

DETROIT FOUNDRY SUPPLY CO., Detroit.—Revolving sand sifters, Crandall cupolas, and air-cooled gagger board.

DIAMOND CLAMP & FLASK CO., Richmond, Ind.—Three core machines, including a No. 1 small machine for making small cores from 3-16 to ¾ inches, and a No. 2 machine for making cores from ⅜ inch to 3 inches, with duplicates from ⅜ to 1 inch, the machine making two of the smaller sizes at one time. Another machine shown had a capacity for making 57 varieties of cores, feeding cores, stop-off cores, chambers, etc. Belt shifters and quarter angle couplings were also shown.

DIXON, JOS., CRUCIBLE CO., Jersey City, N. J.—At the four corners of this exhibit large retorts were placed containing potted plants. In the place of a railing, crucibles of different sizes were arranged with the largest ones in the centers, graduating to the smaller sizes toward the retorts. One side of the crucible fence which enclosed the exhibit consisted of new crucibles and another was made up of diseased ones, each tagged to explain how the crucible gave out and the reasons for the same. Old crucibles that had run 60, 70, and 80 heats in Steele-Harvey furnaces and in the ordinary pit furnaces were also shown and labeled. Crucible fixings, such as stoppers, nozzles, stirrers, etc., were displayed in a show case on a pedestal stand and in another show case were placed

EXHIBIT—CLEVELAND WIRE SPRING CO.

glass bottles containing graphite for facings, etc.

DOGGETT, STANLEY, New York.—Exhibit of Perfection parting compound, charcoal and soapstone facings.

DRUCKLIEB, C., New York.—Three sizes of injector sand blast apparatus, for cleaning castings and other work, manufactured by this company, as follows: 24 x 24 inches, with a capacity of 500 pounds of sand at one filling; 30 x 36 inches, with a capacity of 1,200 pounds of sand; 30 x 48 inches, with a capacity of 2,000 pounds of sand, and samples of hose nozzle holders, couplings, nozzles and other attachments for use with these machines.

ETTING, EDWARD J., Philadelphia.—The Etting No. 46 cupola, rumbling barrels, foundry ladles, and Dings electro-magnetic separators.

FALLS RIVET & MACHINE CO., Cuyahoga Falls, O.—Two Wadsworth improved core ovens, one shown in operation, and the other one loaded with cores, which permitted an examination of the shelves when full; five coremaking machines and special cores made on the Wadsworth improved core machine; one friction drive rumbling barrel; one gagger mold, with demonstration of the method by which the gaggers are cast.

FOUNDRY SPECIALTY CO., Cincinnati.—A complete line of compounds for partings and facings for brass and iron work, as well as Fluxine, a new metal cleaner which was recently placed on the market. Molds were made at this exhibit by an experienced molder and the use of various parting compounds and facings demonstrated.

FOX MACHINE CO., Grand Rapids, Mich.—Display of Universal Trimmers.

GARDEN CITY SAND CO., Chicago.—Samples of a complete line of molding sands, as well as E. L. cupola blocks.

GOLDSCHMIDT THERMIT CO., New York.—Various appliances for heating and purifying metals with demonstrations of welding and burning, pipe welding, and apparatus for welding by the use of thermit.

GUNN, RICHARDS & CO., New York and Montreal, Canada.—Production engineers and public accountants.

HANNA ENGINEERING WORKS, Chicago.—Air and electrically driven sand shakers, pneumatic punches and riveters.

HARRINGTON, EDWIN, SON & CO., Philadelphia.—Peerless hoists in various sizes and of various types.

HAWLEY DOWN DRAFT FURNACE CO., Chicago.—Schwartz metal melting furnaces.

HERMAN PNEUMATIC MACHINE CO., Zelienople, Pa.—Three different types of jarring molding machines. A novel and rapid method of making intricate grate bars was shown on the company's new grate bar machine designed especially for this purpose, although it can also be used for other work of similar flask dimensions. In making grate bars the pattern is fastened to the bottom board and the flask is placed over the same and filled with sand. The air is then applied, which causes an up and down movement of the table plate, which strikes upon a resilient surface. The time required to pour the mold in this manner is about 30 seconds. The table plate bearing the flask

EXHIBITS—DETROIT FOUNDRY SUPPLY CO., KERR TURBINE CO., GARDEN CITY SAND CO. AND ROBESON PROCESS CO.

is then raised and the side lifters thrown in position. The plate is next lowered and the flask turned over in the trunnions. The table plate is next engaged to meet the flask, which is drawn from the pattern and lifted to the floor. In making this mold, nails, anchors or sand hooks are dispensed with and no hand ramming is required. Venting is obviated, as the sand is jarred uniformly and will pack densely around the pattern, while the top is less compressed and is therefore more porous and permits of an easy escape of the gases. Another machine exhibited was built entirely of steel and designed to meet the requirements of steel foundries. On this machine was mounted a draw bar pattern with stripping plate. The ramming is done in a manner similar to that heretofore described and when the mold is completely rammed, the table plate, together with the pattern and flask, is raised and the lifters placed in position. The pattern is then drawn through the stripping plate and the mold lifted to the floor. Another machine shown was used in making skein boxes.

HOERMANN, A. E., New York.—One 1,000-pound sand capacity Barnham sand blast machine and all sizes and types of Green chipping, calking and riveting hammers; sand rammers, hose couplings, as well as photographs and illustrations of cranes, hoists, compressors, trolleys, etc.

HOLLAND LINSEED OIL CO., Chicago.—Pure Open Kettle boiled linseed oil and liquid compounds, together with samples of large cores successfully made with these compounds.

KERR TURBINE CO., Wellsville, N. Y.—Turbine engine direct connected to a fan.

KEYSTONE GREASE CO., Philadelphia.—Greases and lubricants for all classes of machinery.

KILLING MOLDING MACHINE CO., Davenport, Ia.—Molding machines of the roll-over and straight draft types; roll-over drop machines; roll-out molding machines; stripping plate molding machines, and air, water or steam power driven sand sifters.

KOPPEL, ARTHUR, CO., New York.—Industrial railway, dump cars, portable tracks, switches and turntables.

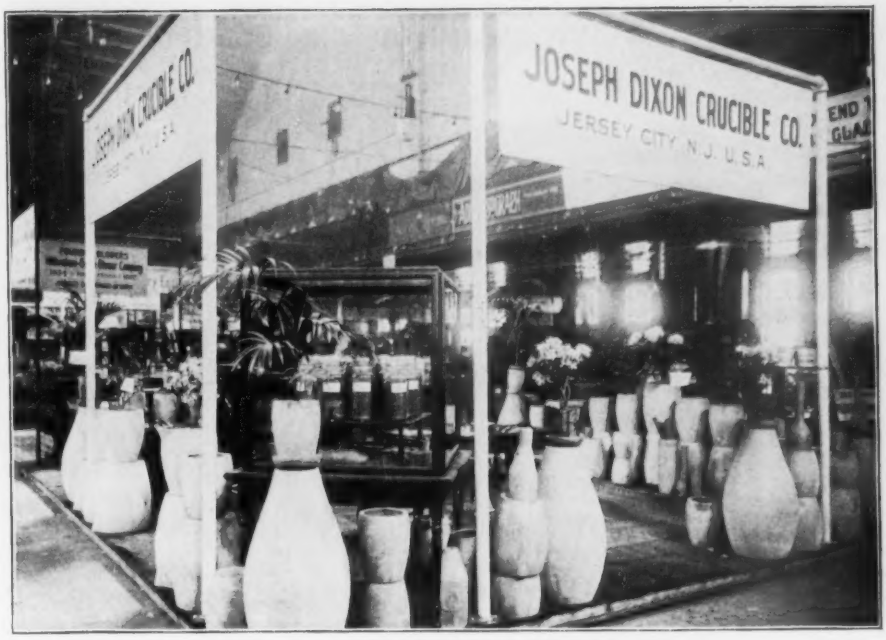
LIBRARY BUREAU, New York.—Systematizing methods.

LINDSAY, W. W., & CO., Philadelphia.—Complete line of foundry chaplets and anchors made by this concern in all sizes to meet the varying requirements of the foundry trade.

LINK-BELT CO., Nicetown, Philadelphia.—Conveying machinery, reciprocating sand elevator and conveyor and Renold silent chain drive. Reciprocating sand elevator and conveyor was shown in operation.

MACPHAIL FLASK AND MACHINE CO., Chicago.—Taper snap flasks and jackets, steel bottom boards and other foundry supplies.

MILLS, C. E., OIL CO., Syracuse, N. Y.—Core compounds both liquid and dry. This exhibit was fenced in with the green barrels with yellow heads containing the compound manufactured by this company.



EXHIBIT—JOSEPH DIXON CRUCIBLE CO.

MITCHELL-PARKS MFG. CO., St. Louis.—In addition to its space in the Armory this company exhibited its Gravity molding machine in the foundry of the Bernstein Mfg. Co., in Philadelphia. Automobiles operated between the Armory and the foundry, which carried visitors to the company's exhibit. Fifteen minute service was in effect for five days and hundreds availed themselves of the opportunity of seeing this machine in operation.

MONARCH EMERY & CORUNDUM WHEEL CO., Camden, N. J.—Full line of emery and corundum wheels and electrically driven grinders. An interesting feature of this exhibit was the practical demonstration of the use of an emery or corundum wheel shown in operation.

MONARCH ENGINEERING & MFG. CO., Baltimore, Md.—Monarch melting furnaces were shown in operation, as well as Monarch burners for core ovens and molds. This exhibit also contained a display of core ovens.

MUMFORD, E. H., CO., Philadelphia.—Molding machines plain power rammers, with match plates of both steel and aluminum; No. 2 Pridmore machine; No. 3 Pridmore machine with Mumford vibrator and frame; power ramming split pattern machine and a sand shaker with the Mumford loose rings adapted for supplying sand to molding machines.

McCORMICK, J. S., CO., Pittsburg.—Sand mixer with a capacity of 4 to 8 tons per hour; Farwell Universal molding machine; Reid molding machine; 20th Century molding machine and adjustable crucible tongs.

NEW ENGLAND ENGINEERING & EQUIPMENT CO., Boston.—This exhibit was made in connection with that of the W. W. Sly Mfg. Co., Cleveland, which this concern represents in the New England territory. It included electric and pneumatic cranes, hoists, cupolas, ladles, etc.

NORTHERN ENGINEERING WORKS, Detroit.—This exhibit consisted of one electric C type Northern chain block, with I-beam roller bearing trolley; one Champion No. 2 patent air hoist, 1-ton capacity; one geared crane ladle, with encased gearing, together with photographs of electric Northern cranes and foundry equipment, including a Newton cupola and Keep's sectional cupola.

OBERMAYER, S., CO., Cincinnati.—This booth was elaborately furnished with chairs, desks, etc., and was provided with telephones and a stenographer for the use of the patrons and friends of the concern, where new acquaintances were accorded a cordial welcome by its host of representatives.

OLIVER MACHINERY CO., Grand Rapids, Mich.—Patternmakers' lathe, band saw, Universal saw bench and No. 3 trimmer.

OSBORN MFG. CO., Cleveland.—Complete line of foundry and factory supplies, such as shovels, riddles, wire brushes, both circular and hand brushes, platers' brushes, heavy foundry brooms, and other miscellaneous foundry supplies. The exhibit consisted of two large pyramids, on which these goods were attractively displayed.

OTTO GAS ENGINE WORKS, Philadelphia.—Sixty-horsepower Otto gas engine, which operated a 45-kilowatt Crocker-Wheeler

EXHIBIT—FALLS RIVET & MACHINE CO.

generator and furnished power for driving the working exhibits.

PANGBORN, THOMAS W., CO., New York.—Elaborate display of foundry equipment, which included the Pangborn sand blast machine; molding sands and clay products; Hammer core machines; Hanna pneumatic punches and riveters; air, steam and electrically driven sand shakers, and other foundry supplies.

PAXSON, J. W., CO., Philadelphia.—This exhibit was divided into four sections, the first containing the office. The second showed molding machines in operation, as well as centrifugal sand mixers and sand bins showing the various sands used in foundries in the eastern section of the country. In the third section the art of making sieves, bellows and brushes was shown and included a wire drawing machine and a large column on which was displayed the full line of brushes, sieves and bellows manufactured by this concern. The fourth section contained a display of the various types of brass melting furnaces, sprue cutters, skin drying stoves, magnetic separators, core ovens, tumbling barrels, and other small equipment for use in the foundry. In conjunction with this exhibit the Wilbraham-Green Blower Co. showed a blower in operation and a complete line of crucibles made by the Jos. Dixon Crucible Co. was also displayed. In the center of this exhibit a Paxson-Colliau cupola was shown surrounded by hay rope and ladle bowls.

PETTINOS BROS., Bethlehem, Pa.—This exhibit included the various products of this company's American and Mexican mines, consisting of lubricating and crucible flake graphites, foundry dust, blacking, etc., and the various grades of lump, chip and dust plumbago imported directly from the island of Ceylon, including the highest qualities for every purpose. Specimens of graphite ores taken from this company's numerous deposits were also displayed, as well as samples of its general line of facings, talcs and clays, molding sand and core gravels, and various articles of foundry equipment manufactured and handled by this concern.

PRIDMORE, HENRY E., Chicago.—Four molding machines, of the new style rock-over and drop types, were shown in operation. A stripping plate machine, 10 x 12 inches, was fitted with a set of standard M. C. B. brake shoe patterns.

PRIMOS CHEMICAL CO., Primos, Delaware county, Pa.—This exhibit contained a very full display of ferro and other alloys.

RANDALL TRAMRAIL CO., Philadelphia.—Moyer system of overhead tramrail transmission was shown in operation.

RENDLE, ARTHUR E., New York.—Paradigm skylights, fireproof windows and sidelights.

ROBESON PROCESS CO., Camden, N. J.—This exhibit consisted of various barrels of Glutrin taken from the company's stock ready for shipment, which were arranged around the edge of this space instead of a railing. The booth was fitted up as an office for the accommodation of the company's patrons, and a stenographer was furnished for their exclusive use.

ROCKWELL ENGINEERING CO., New York.—Fuel oil burning appliances; double chamber Rockwell melting furnaces, and ladle

EXHIBITS—GOLDSCHMIDT THERMIT CO., MITCHELL-PARKS MFG. CO., AND A. BUCH'S SONS

heaters. Practical demonstrations were made of the operation of these furnaces.

SEIDEL, R. B., INC., Philadelphia.—Plumbago crucibles for melting all kinds of metals, special shapes, etc., manufactured by this company.

SLY, W. W., MFG. CO., Cleveland.—Core sand cleaner, dust arrester, resin grinders, exhaust tumbling barrels, and other foundry equipment.

SMITH, J. D., FOUNDRY SUPPLY CO., Cleveland.—Water tumbling barrels, sprue cutting machines, long bearing emery grinders, brass furnace, aluminum melting furnace, core oven, car, ball bearing turntables, core oven, pneumatic sand sifter, and the Cleveland molding machine.

SMYTH, SWOBODA & CO., New York.—Parting compound known by the trade name of Lycopart; samples were distributed and demonstrations were made showing the uses and advantages of this compound.

STANDARD SAND & MACHINE CO., Cleveland.—One No. 4 Standard continuous automatic sand mixing machine and a No. 2 pulverizer, which were erected in a self-contained frame, together with a feed hopper and elevator with a direct attachment of a 10-horsepower motor. The mixing plant had a capacity of from 15 to 18 tons per hour.

STURTEVANT, B. F., CO., Hyde Park, Mass.—Thirty-inch propeller fan; 7½-kilowatt generating set; No. 3 monogram exhaust fan; No. 9 steel pressure blower; working model of a high pressure blower; 30-inch steel plate mill exhaust fan; No. 9 direct connected high pressure blower; 18-inch disc fan, blast gates and other apparatus.

TABOR MFG. CO., Philadelphia.—Twenty-four-inch hinge molding machine with hand draft; 24-inch hinge machine with 7-inch hand draft and equalizer; 14 x 16-inch split pattern molding machine; 10, 13 and 16-inch power ramming machines, and a 36-inch Taylor-Newbold inserted tooth cold saw.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—Complete line of graphite products for foundry use.

WILBRAHAM-GREEN BLOWER CO., Philadelphia.—Three motor driven foundry blowers, two of which were shown in operation; one was of an entirely new design, which embraced originally patented features not included in the present Green rotary pressure blower.

YALE & TOWNE MFG. CO., New York.—This exhibit contained a 2-ton portable electric hoist equipped with a "KY" type motor; a 2-ton portable electric foundry hoist, with a graduated speed controller for delicate foundry operations, and was equipped with a nominal 3-horsepower motor. This exhibit also contained one 20-ton triplex chain block which enables a single operator to lift a full 20-ton load at slow speed. Plain and geared steel trolleys for operating on bottom flanges of a single I-beam were also shown, as well as 1-ton triplex, duplex and differential chain blocks in operation under loads indicating the comparative efficiencies of the three types of chain blocks.

EXHIBITS—STANLEY DOGGETT AND GUNN, RICHARDS & CO.

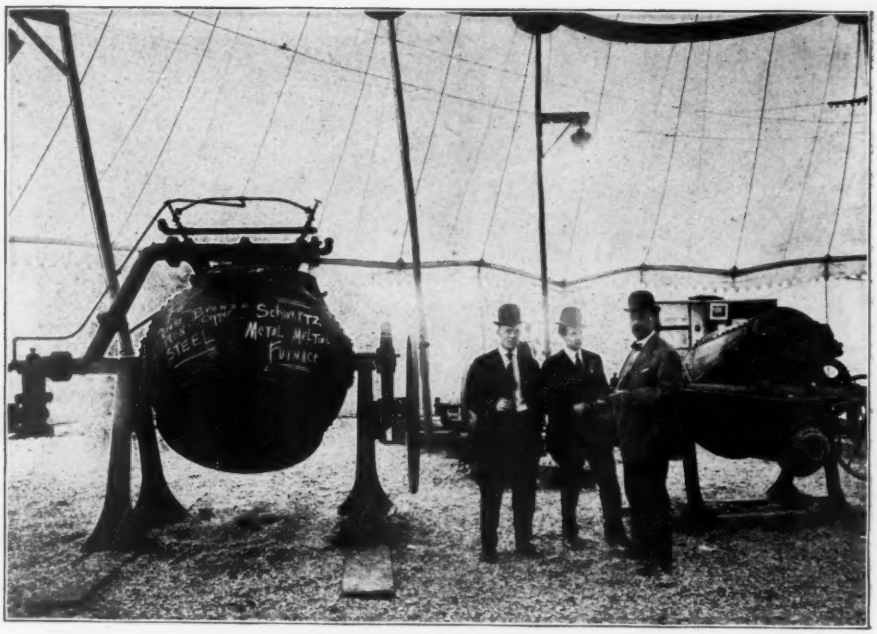
THE CONVENTION ENROLMENT

ABELL, Ed. R., Haines, Jones & Cadbury Co., Philadelphia; N. Anderson, Camden, N. J.; L. R. Ashenfelter, Matthew Addy & Co., Pittsburg; Robert Adamson, Farrell Foundry & Machine Co., Ansonia, Conn.; J. A. Agnew, Dawes & Myler S. S. M. Co., New Brighton, Pa.; E. N. Anthony, Smith & Anthony Co., Boston, Mass.; Chas. G. Allen, Chas. G. Allen & Co., Barre, Mass.; E. R. Allen, E. R. Allen Foundry Co., Corning, N. Y.; Thos. N. Allen, Nelson Valve Co., Wyndmoor, Pa.; Gustavus Anderson, Harrison Safety Boiler Works, Philadelphia; D. E. Allen, Addressograph Co., Chicago; W. E. Arnold, L. R. Wister & Co., Philadelphia; Axel Anderson, Moline Plow Co., Moline, Ill.; A. C. Albrecht, North Bros. Mfg. Co., Philadelphia; Wm. Albrecht, Landers, Frary & Clark, New Britain, Conn.; Charles Alaud, Jas. B. Clow & Sons, Newcomerstown, O.; L. L. Anthes, Toronto Foundry Co., Ltd., Toronto, Can.; J. C. Armer, Editor *Canadian Machinery*, Toronto, Can.; J. L. Anthony, Weir Stove Co., Taunton, Mass.; M. Aikens, Berkshire Mfg Co., Cleveland; T. A. Angell, Boynton Furnace Co., Jersey City, N. J.; Chas. L. Ackerson, Syracuse Aluminum & Bronze Co., Syracuse, N. Y.; S. W. Anness, Southern Machinery Co., Atlanta, Ga.; Robert Agnew, Canadian Locomotive Co., Kingston, Ont.; John Alexander, Harrison Safety Boiler Works, Philadelphia; Chas. W. Asbury, Enterprise Mfg. Co., Philadelphia; H. R. Attwater, Osborn Mfg. Co., Cleveland; H. N. Anderson, Cortland Corundum Wheel Co., Cortland, N. Y.; I. J. Allen, Demarest Mfg. Co., Williamsport, Pa.

BOWEN, I. J., Thomas W. Pangborn, New York; S. C. Bougher, J. W. Paxson Co., Philadelphia; Sherman Bougher, J. W. Paxson Co., Philadelphia; J. K. Bougher, J. W. Paxson Co., Philadelphia; Jonathan Bartley, Joseph Dixon Crucible Co., Jersey City, N. J.; Clarence R. Brown, E. E. Brown & Co., Philadelphia; H. G. Boughton, Standard Sand & Mach. Co., Cleveland; C. F. Battenfield, Berkshire Mfg. Co., Cleveland; J. C. Boynton, Osborn Mfg. Co., Cleveland; J. N. Battenfield, Berkshire Mfg. Co., Cleveland; H. M. Bougher, J. W. Paxson Co., Philadelphia; T. Harold Brown, Buchanan Foundry Co., Lebanon, Pa.; T. J. Best, Best Steel Casting Co., Montreal, P. Q., Can.; Cyrus Borgner, Cyrus Borgner Co., Philadelphia; Elmer E. Brown, M. D., E. E. Brown & Co., Philadelphia; S. D. V. Burr, *Metal Industry*, New York; A. Bachman, Buckeye Foundry Co., Cincinnati; H. A. Buzby, Keystone Lubricator Co., Philadelphia; Henry Barton, Henry E. Pridmore, Chicago; E. F. Burns, Otto Gas Engine Co., Philadelphia; David Black, Estate Stove Co., Hamilton, O.; W. H. S. Bateman, Philadelphia Pneumatic Tool Co., Philadelphia; H. F. Baldwin, Sullivan Machinery Co., Claremont, N. H.; A. O. Backert, editor THE FOUNDRY, Cleveland; William Blair, North & Judd Co., New Britain, Conn.; L. D. Beitzel, U. S. Arsenal, Watertown, Mass.; Wm. P. Bernstein, Bernstein Mfg. Co., Philadelphia; E. A. Bernstein, Bernstein Mfg. Co., Philadelphia; R. S. Buch, A. Buch's Sons Co., Elizabethtown, Pa.; J. H. Buch, A. Buch's Sons Co., Elizabethtown, Pa.; E. E. Breyer, Belknap Mfg. Co., Bridgeport, Conn.; W. L. Belknap, Belknap Mfg. Co., Bridgeport, Conn.; Geo. A. Burman, King Radiator Co., Toronto, Can.; John J. Bruce, John J. Bruce Foundry Co., Cincinnati; H. Black, Robert Field Co., Cincinnati; J. M. Betton, C. Drucklieb, New York; Clark Butts, Medina Foundry Co., Medina, N. Y.; Wm. Barsley, N. Y. Shipbuilding Co., Camden, N. J.; Frank S. Barnett, O. Barnett Foundry Co., Newark, N. J.; J. B. Bernhard, Garwood Foundry & Mach. Co., Garwood, N. J.; S. Roscoe Bateman, Bateman Mfg. Co., Grenloch, N. J.; J. Ross Bates, Whiting Foundry Equipment Co., Boston; H.

EXHIBIT—HANNA ENGINEERING WORKS

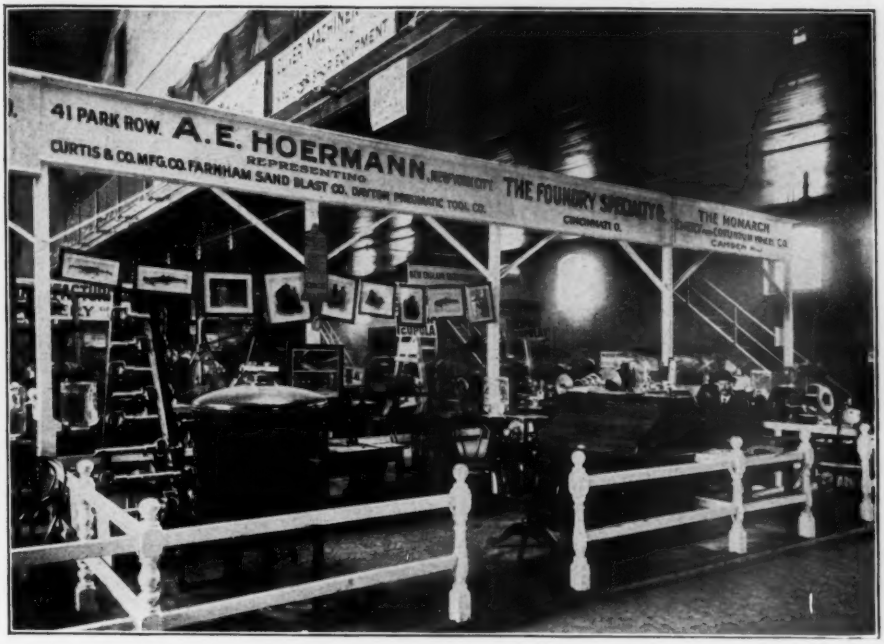
W. Bullard, Poughkeepsie Foundry & Machine Co., Poughkeepsie, N. Y.; James Bradford, Lord & Berman Co., Evanton, N. Y.; M. H. Bickley, Penn Steel Casting Co., Chester, Pa.; Donald Brown, S. H. Barnum Co., New Haven, Conn.; J. B. Bonner, Carnegie Steel Co., Philadelphia; Jos. Bobenrieth, Theo. B. Rohrman, Philadelphia; David Bell, Dominion Coal Co., Glace Bay, N. S.; Geo. Benkert, Fairmount Foundry Co., Philadelphia; C. O'D. Blanchfield, *Industrial World*, Pittsburg; W. S. Bickley, Penna. Steel Casting & Machine Co., Chester, Pa.; J. M. Barron, Pulaski Iron Co., Philadelphia; G. C. Batten, J. B. Morris Foundry Co., Cincinnati; A. K. Beckwith, Estate of P. D. Beckwith, Inc., Dowagiac, Mich.; A. F. Beavens, Hancock Inspirator Co., Boston; H. W. Brown, Tabor Mfg. Co., Philadelphia; E. L. Binns, Superior Drill Co., Springfield, O.; F. M. Bedell, The S. C. Tatum Co., Cincinnati; J. H. Brooks, T. B. Harkins Foundry Co., Bristol, Pa.; M. B. Buckman Jr., Cooper Hewitt Elec. Co., Philadelphia; Cliff Bleyer, Hawley Down Draft Furnace Co., Chicago; W. R. Bean, T. H. Symington Co., Corning, N. Y.; W. J. J. Bowman, J. L. Mott Co., Trenton, N. J.; Wm. J. Brant, Miller's Product Co., Pittsburg; Henry D. Boyer, Keystone Foundry Co., Philadelphia; H. R. Barnhard, Lehigh Foundry Co., Fullarton, Pa.; J. C. Bannister, Western Tube Co., Kewanee, Ill.; J. J. Bever, Otis Steel Co., Cleveland; Harry L. Bell, Dodge Mfg. Co., Mishawaka, Ind.; J. W. Bumbaugh, National Tube Co., McKeesport, Pa.; E. C. Bailey, Milford Iron Co., Milford, Mass.; Chas. F. Brown, Utica Heater Co., Utica, N. Y.; J. W. Busch, Pratt & Cady Co., Hartford, Conn.; Wm. H. Baush, Confectioners' Machinery & Mfg. Co., Springfield Mass.; A. N. Bates, Erie Foundry Co., Erie, Pa.; James Bolland, E. W. Bliss Co., Brooklyn, N. Y.; Charles F. Bartlett, Philadelphia; James F. Brown, Mesta Machine Co., Pittsburg; C. L. Bell, C. L. Bell Co., Hillsboro, O.; Robert C. Bird, Broadway Iron Foundry Co., Cambridge, Mass.; William Blair, North & Judd Mfg. Co., New Britain, Conn.; Geo. Booker, Fort Pitt Malleable Co., Pittsburg; H. M. Brewster, Millett Core Oven Co., Springfield, Mass.; Chas. C. Bacon, Ross Tacony Crucible Co., Tacony, Philadelphia; James A. Beckett, Walter A. Wood M. & R. M. Co., Hoosick Falls, N. Y.; John W. Burr, Burnhouse & Co., Brooklyn, N. Y.; Fred Blundell, Taylor & Boggis Foundry Co., Cleveland; C. C. Boyden, Matthew Addy & Co., Philadelphia; M. J. Brennan, Brennan Sign Co., Tillytown, Pa.; F. C. Brooksbank, Tilghman-Brooksbank Sand Blast Co., Philadelphia; C. H. Bierbaum, Lumen Bearing Co., Buffalo; William H. Barr, Lumen Bearing Co., Buffalo; J. H. Berryhill, Vulcan Plow Co., Evansville, Ind.; Howard P. Barrass, Foran Foundry & Mfg. Co., Flemington, N. J.; Robert Blythe, Walker & Pratt Mfg. Co., Watertown, Mass.; Theo. S. Beeson, Wm. Todd Co., Youngstown, O.; Stockton G. Barnett, Brass Founders' Supply Co., Newark, N. J.; Jos. Bretteaud, Paris; S. M. Blackburn, John B. Morris Foundry Co., Cincinnati; Raymond B. Brown, Duquesne Reduction Co., Pittsburg; Lewis E. Bellows, Barlow Mfg. Co., Holyoke, Mass.; R. P. Brown, Cyrus Borgner Co., Philadelphia; R. W. Barwood, Barwood & Snider, Philadelphia; George E. Bates, Baltimore Foundry Co., Baltimore; R. A. Bull, Commonwealth Steel Co., Granite City, Ill.; J. M. Brady, Detroit Lubricator Co., Detroit; T. Davidson Brown, American Ferrofix B. Co., Philadelphia; H. W. Berry, Walker Foundry Co., Erie, Pa.; Frank J. Berchtold, Erie Engine Co., Erie, Pa.; G. A. Barden, Chicago Pneumatic Tool Co., Philadelphia; John Brand, Mitchell Parks Mfg. Co., St. Louis; Thos. N. Burman, Shirley Radiator & Fdy. Co., Shirley, Ind.; John K. Brown, Damascus Bronze Works, Pittsburg; W. R. Beers, Detroit Foundry Supply Co., Detroit; Walter C. Boynton, *Copper & Brass*, Detroit; A. W. Bair, C. M. & St. P. Ry. Co., Milwaukee; A. L. Boughton, Standard Sand & Machine Co., Cleveland; T. Ben Bennett, D. Maxwell & Sons, St. Mary's, Ont.; James W. Burman, U. S. Radiator Co.,



EXHIBIT—HAWLEY DOWN DRAFT FURNACE CO.

Dunkirk, N. Y.; P. B. Baumgardner, Holland Linseed Oil Co., Chicago; A. P. Bean, T. H. Symington Co., Corning, N. Y.; Benj. Booz, Southern Stove Works, Richmond, Va.; H. Born Jr., Born Steel Range Co., Cleveland; John Birkinbine, Philadelphia: A. H. Beale, Easton Steel Co., Pottsville, Pa.; Geo. C. Brill, I. A. Sheppard & Co., Philadelphia; M. C. Burns, Westinghouse Foundry Co., Pittsburg; R. A. Byrnt, Northern Engineering Works, New York; J. H. Bing, Pettinos Bros., Philadelphia; James Bowie, Builders' Iron Foundry, Providence, R. I.

CAVANAUGH, F., Roberts, Winner & Co., Quakertown, Pa.; H. L. Conner, Roberts, Winner & Co., Quakertown, Pa.; C. W. Coleman, Tabor Mfg. Co., Philadelphia; Frank Cordingly, Mill, Griffith & Co., Denver, Colo.; John Cox, Cox Brass Co., Albany, N. Y.; W. E. Crist, Crist Valve Mfg. Co., Chittenango, N. Y.; R. J. Cluff, King Radiator Co., Toronto, Can.; A. C. Crist, Crist Valve Co., Chittenango, N. Y.; J. N. Carter, J. N. Carter & Co., Philadelphia; F. A. Coleman, J. D. Smith Foundry Supply Co., Cleveland; P. S. Crawford, U. S. Graphite Co., Saginaw, Mich.; J. Carew, Essex Foundry, Newark, N. J.; Geo. F. Crivel, Geo. F. Crivel Co., Buffalo; E. M. Chapman, William M. Crane Co., Peekskill, N. Y.; Edgar S. Cook, Warwick I. & S. Co., Pottstown, Pa.; M. F. Carr, J. W. Paxson Co. Philadelphia; Benj. H. Cramp, Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia; Wm. J. Coane, Joseph Dixon Crucible Co., Jersey City; Capt. W. H. Colwell, Washington, D. C.; W. W. Cheney, S. Cheney & Son, Manlius, N. Y.; H. J. Caster, Youngstown Bronze & Iron Foundry, Youngstown, O.; James Cherrie, Friction Pulley Works, Sandy Hill, N. Y.; Theo. H. Colvin, Colvin Foundry Co., Providence, R. I.; C. W. Coleman, Tabor Mfg. Co., Providence, R. I.; Wm. Caskey, Caskey Brass & Bronze Works, Philadelphia; W. P. Cunningham, American Bridge Co., Pencoyd, Pa.; W. T. Cullen, Frontier Iron Works, Buffalo; J. S. Caffrey, Smith & Caffrey Co., Syracuse, N. Y.; H. L. Caely, Hart & Crouse Co., Utica, N. Y.; Chas. J. Caley, Russell & Erwin Mfg. Co., New Britain, Conn.; F. Campbell, Taylor Forbes Co., Guelph, Ont.; L. L. Carson, *Industrial World*, Pittsburg; H. B. Cutter, Cast Thread Fitting & Foundry Co., Seneca Falls, N. Y.; Geo. E. Camp, International Heater Co., Utica, N. Y.; Walter O. Conley, Cooper-Hewitt Elec. Co., Philadelphia; A. A. Capelle, Northern Engineering Works, Detroit; Chas. Cook, Harrison Safety Boiler Works, Philadelphia; Wm. Cook, Haines, Jones & Cadbury Co., Norristown, Pa.; G. A. Carolin, Enterprise Foundry Co., Detroit; F. F. Chadwick, Davis Coal & Coke Co., Cumberland, Md.; Lyon Cohen, W. R. Cuthbert & Co., Montreal, P. Q.; J. Connell, Assistant Inspector Engineering Material, U. S. Navy; C. M. Culver, Murphy Iron Works, Detroit; C. A. Chase, Syracuse Chilled Plow Co., Syracuse, N. Y.; Geo. Castor, Donaldson Iron Co., Emanus, Pa.; F. H. Chamberlin, J. D. Smith Foundry & Supply Co., Cleveland; P. A. Clum, Clum & Atkinson, Rochester, N. Y.; R. L. Clark, American Brake Shoe & Foundry Co., Mahwah, N. J.; F. Comstock, Norwalk Brass Co., Norwalk, Conn.; A. F. Corbin, Union Mfg. Co., New Britain, Conn.; Robert Crawford, Scott Printing Press Co., Plainfield, N. J.; J. N. Courtney, A. Buch's Sons Co., Buffalo; Wm. H. Carpenter, Pilling & Crane, New York; Addison N. Clark, *Engineering News*, New York; Chas. L. Cushmore, Williamson Bros. Co., Philadelphia; J. Alfred Clark; Clark's Iron Foundry, Philadelphia; John H. Cochrane, J. Walter Miller Co., Lancaster, Pa.; Alfred Crook, Gibson Iron Works Co., Jersey City; J. W. Cooley, National Meter Co., New York; Henry A. Carpenter, A. Carpenter & Sons Foundry Co., Providence; C. J. Chaupient, Iola, Kas.; L. A. Crandall, Detroit Foundry Supply Co., Detroit; J. W. Campbell, Cleveland Wire Spring Co., Cleveland; F. J. Crawford, M. W. Kellogg Co., Newark, N. J.; Wm. Chambers, Garden City Sand Co., Chicago; Wm. M. Corse, Detroit Lubricator Co., Detroit; Courtland D. Cramp, Wm. Cramp & Sons Ship & Engine Building


41 PARK ROW. A. E. HOERMANN, REPRESENTING
CURTIS & CO. MFG. CO. FARNHAM SAND BLAST CO. DAYTON PNEUMATIC TOOL CO.
THE FOUNDRY SPECIALTY CO.
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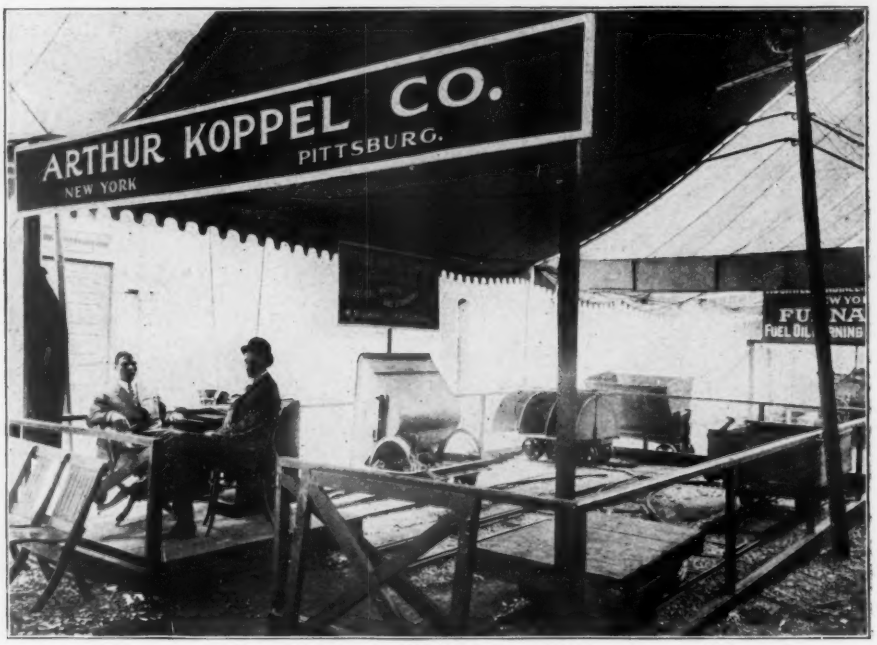
GOOD, Thos. R., W. & B. Douglas Pump Mfg. Co., Middletown, Conn.; J. P. Golden, Golden's Foundry & Machine Co., Columbus, Ga.; W. W. Gulick, M. F. Gulick Sand Co., Riverside, Pa.; L. Gobeille, Abram Cox Stove Co., Philadelphia; C. N. Gale, Penna. Malleable Co., Pittsburg; H. J. Gearhart, Central Car Wheel Co., Pittsburg; John R. George, Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y.; Walter Gray, Reed Foundry Co., Worcester, Mass.; I. A. Gutsche, L. S. & M. S. Ry. Co., Cleveland; J. N. Gamble, Western Tube Co., Kewanee, Ill.; T. H. Gartland, Best Foundry Co., Bedford, O.; I. A. Gaible, The Brownell Co., Dayton, O.; E. N. Gould, American Ferrofix Brazing Co., Philadelphia; William F. Grunau, Erie City Iron Works, Erie, Pa.; C. M. Goldman, S. Obermayer Co., Pittsburg; A. M. Guenther, Goldschmidt Thermit Co., New York; Jas Gilbert, Jackson Church Co., Saginaw, Mich.; N. F. Gould, U. S. Radiator Co., Dunkirk, N. Y.; Jos. H. Gartside, Diamond Clamp & Flask Co., Richmond, Ind.; C. Gorman, Nelson Valve Co., Philadelphia; M. J. Goepfert, Belle City Malleable Iron Co., Racine, Wis.; Thos. W. Green, Wilbraham-Green Blower Co., Philadelphia; Wm. M. Graham, Green Fuel Economiz-

EXHIBITS—KILLING MOLDING MACHINE CO. AND EDWARD J. ETTING

er Co., Matteawan, N. Y.; Fred W. Gerhard, Cyrus Borgner Co., Philadelphia; J. A. Gagnon, Montreal, Can.; P. J. Greider, Bethlehem Steel Co., Philadelphia; John F. Grant, E. Brown & Son, Philadelphia; J. P. Goldman, Golden's Foundry & Machine Co., Columbus, Ga.; F. E. Gordon, Ohio Sand Co., Buffalo; H. W. Gilbert, N. Y. C. & H. R. Ry., Frankfort, N. Y.; L. D. Gilbert, Frick Co., Waynesboro, Pa.; W. H. Goldstein, Norwalk Brass Co., Norwalk, Conn.; Walter H. Geier, Modern Foundry Co., Cincinnati; J. H. Godfrey, American Brake Shoe & Foundry Co., Mahwah, N. J.; H. B. Greiner, Philadelphia Pneumatic Tool Co., Philadelphia; W. B. Greene, Palmer & DeMooy Fdry. Co., Cleveland; J. Goschenhofer, Enterprise Foundry Co., Detroit; J. B. Greenig, Pulaski Iron Co., Philadelphia; R. Gungery, Wheeling Mold & Foundry Co., Wheeling, W. Va.; Arthur L. Goodnow, L. H. Goodnow Foundry Co., Fitchburg, Mass.; Thos. Glasscock, Pawling & Harnischfeger, Milwaukee; F. E. Gordon, Ohio Sand Co., Conneaut, O.; N. C. Gibbons, Hilles & Jones Co., Wilmington, Del.; Oliver Gee, Matthew Addy & Co., Philadelphia; M. R. Gano, J. K. Dimmick & Co., Philadelphia; J. R. Gordon, F. H. Lovell & Co., Arlington, N. J.; J. H. Gill, Raleigh, N. C.; J. W. Gorman, Ridgway Machine Co., Ridgway, Pa.; Geo. H. Griffiths, Penton Publishing Co., Chicago; Wm. N. Gartside, Diamond Clamp & Flask Co., Richmond, Ind.; Jacob Goehring, J. W. Paxson Co., Philadelphia; James Glenn, E. E. Brown & Co., Philadelphia; John Glover, Glover Bros., Philadelphia; Wm. Gilbert Jr., Buckeye Foundry Co., Cincinnati; John Gow, General Electric Co., Schenectady, N. Y.; H. B. Gaylord, B. F. Sturtevant Co., Philadelphia; E. B. Gilmour, A. Buch's Sons Co., Elizabethtown, Pa.; C. J. Goehringer, Foundry Specialty Co., Cincinnati; Wm. H. Grinder, Eastern Steel Co., Pottsville, Pa.; Ben Gomersall, Toledo Casting Co., Toledo, O.; G. W. Gingrich, National Fdry. Mfg. & Sup. Co., Williamsport, Pa.

HALSEY, F. A., *American Machinist*, New York; Wm. H. Hepintall, Torrance Malleable Iron Co., Troy, N. Y.; Wm. W. Hutton, Advance Thresher Co., Battle Creek, Mich.; R. J. Hopper, Pratt & Letchworth Co., Brantford, Ont.; J. S. Hibb, J. W. Paxson Co., Philadelphia; D. W. Hemperly, L. & R. Wister & Co., Philadelphia; W. T. Hartman, P. & F. Corbin, New Britain, Conn.; Edward Hueber, American Saw Mill Co., Hackettstown, N. J.; C. S. Hood, Hood Furnace & Sup. Co., Corning, N. Y.; A. H. Hecker, Wm. Powell Co., Cincinnati; L. E. Harper, Becker-Brainard Milling Machine Co., Hyde Park, Mass.; Robert Hunter, Goldie & McCulloch Co., Galt, Ont.; Chas. E. Howlett, American Steel Foundries, Thurlow, Pa.; J. W. Henderson, Engineers' & Founders' Laboratories, Pittsburg; F. R. Howell, Wm. Howell Co., Philadelphia; Alfred E. Hammer, Malleable Iron Fittings Co., Branford, Conn.; Chas. H. Holt, Wehrle Stove Mfg. Co., Newark, O.; M. L. Heyl, Herman Pneumatic Machine Co., Zelienople, Pa.; J. A. Herkert, Herman Pneumatic Machine Co., Zelienople, Pa.; G. P. Halsey, Erie Foundry Co., Erie, Pa.; John Halbritter, Walworth Mfg. Co., Boston; W. H. Hunt, Williams Adams Foundry Co., Philadelphia; E. L. Hogan, Oliver Machinery Co., Grand Rapids, Mich.; C. G. Howe, West Pulverizing Machine Co., Jersey City; R. T. Hodgkins, Yale & Towne Co., New York; W. L. Hoffman, Tenn. C. I. & R. R. Co., Philadelphia; N. B. Hurd, Russell & Erwin Co., New Britain, Conn.; J. E. Higgins, Higgins & Co., Holyoke, Mass.; W. Huber, A. Buch's Sons, Belleville, Pa.; C. E. Haupt, Danville Foundry & Machine Co., Danville, Pa.; Herbert Holt, Camden Foundry Co., Camden, N. J.; D. J. Higgins, New England Engineering & Equipment Co., Boston; Emil Hensen, National Tube Co., McKeesport, Pa.; F. O. Howlitt, Dodge Mfg. Co., Mishawaka, Ind.; J. E. Hunter, Hunter Machine Co., North Adams, Mass.; Benjamin Holt, Camden Foundry Co., Camden, N. J.; H. Huder, Schaum & Uhlinger, Philadelphia; F. A. Hall, Yale & Towne Mfg. Co., New York; C. J. Houck, Arcade Mfg. Co., Chicago; C. A. Hoover, Nelson Valve Co., Wyndmoor, Pa.;



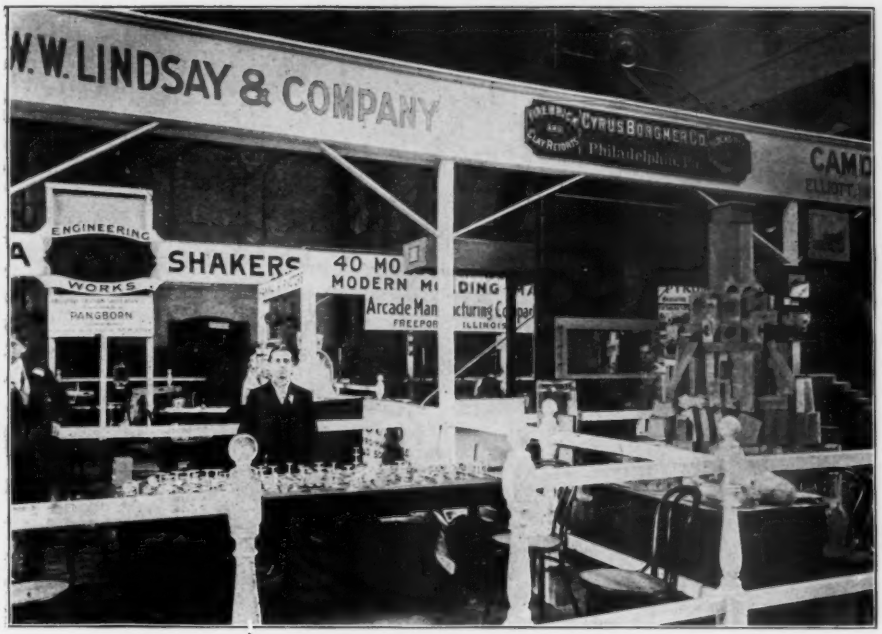
EXHIBIT—ARTHUR KOPPEL CO.

Edw. R. Homiller, Tacony Iron Co., Philadelphia; Wm. Hanson, Pennsylvania Iron Works, Philadelphia; W. H. Hill, Quincy Engine Works, Quincy, Ill.; Arthur B. Howes, Farrell Foundry & Machine Co., Waterbury, Conn.; J. P. Hockin, Taylor Forbes Co., Guelph, Ont.; Walter A. Hardy, Wm. A. Hardy & Sons Co., Fitchburg, Mass.; A. E. Hoerman, New York; Edward Hitzeroth, C. Hitzeroth, Philadelphia; Wm. Hartz, Bethlehem Steel Co., Bethlehem, Pa.; J. R. Homer, Galion Foundry Co., Galion, O.; H. F. Hansell, William Mfg. Co., Norristown, Pa.; Wm. Hendricks, Pittston Stove Co., Pittston, Pa.; Chas. E. Hoyt, Lewis Institute, Chicago; F. V. Hetzel, Link-Belt Engineering Co., Philadelphia; J. E. Harch, Motor Vehicle Register, Philadelphia; Frank Holt, Enterprise Brass Works, Muskegon, Mich.; A. L. Haasis, Jos. Dixon Crucible Co., Jersey City; W. A. Housten, Joseph Dixon Crucible Co., Baltimore; Wm. Hanson, Penna. Iron Works, Philadelphia; H. J. Holmes, L. Schreiber & Sons Co., Norwood, O.; H. L. Haldeman, Pulaski Iron Co., Philadelphia; Frank Hammond, Buchanan Foundry Co., Lebanon, Pa.; Harry W. Hand, Wm. Cramp S. & E. B. Co., Philadelphia; W. W. Hearne, Matthew Addy & Co., Philadelphia; Wm. S. Hallowell, Harrison Safety Boiler Works, Philadelphia; Geo. J. Hessler, Syracuse Foundry Co., Syracuse, N. Y.; Chas. A Hopper, Keystone Lubricator Co., Philadelphia; G. F. Hickmott, Boston Brass Co., Boston; H. D. Harvey, Monarch Engineering & Mfg. Co., Baltimore; Wm. J. Holzapfel, Crescent Mfg. Co., Scottdale, Pa.; L. C. Hirshheimer, La Crosse Plow Co., La Crosse, Wis.; D. P. Hopkins, U. S. Cast Iron Pipe & Foundry Co., Addyston, O.; John O. Henshaw, N. S. Bartlett Co., New York; J. B. Holloway, N. S. Bartlett & Co., Philadelphia; T. B. Harkins Foundry Co., Bristol, Penna.; Geo. A. Hetzler, Sill Stove Works, Rochester, N. Y.; A. F. Horton, North Bros. Mfg. Co., Philadelphia; Gerald Hannay, O. Barnett Foundry Co., Newark, N. J.; Paul Hochart, General Electric Co., Pittsfield, Mass.; Norman Huxley, Homer Brass Works, Chester, Pa.; Eugene D. Hays, Cooper Hewitt Elec. Co., Philadelphia; H. Hertfelder, Dodge Mfg. Co., Toronto, Canada; Wm. A. Hill, Crown Smelting Co., Chester, Pa.; F. Hulie, Berkshire Mfg. Co., Cleveland; James C. Hosford, Magee Furnace Co., Boston; John Hewitt, John Hewitt Foundry Co., East Newark, N. J.; T. Hill, Quincy Engine Works, Quincy, Mich.

ILL, Henry, Universal Castor & Foundry Co., Newark, N. J.; A. W. Inglis, American Locomotive Co., Paterson, N. J.

JONES, T. A., W. A. Jones Foundry & Machine Co., Chicago; G. S. Johnson, Western Foundry Supply Co., East St. Louis, Ill.; David Justice, Pittsburg Valve, Foundry & Con. Co., Pittsburg; John B. Jones, Utica Heater Co., Utica, N. Y.; E. A. Johnson, Winona Technical Institute, Indianapolis, Ind.; D. T. Jones, Wilbraham-Green Blower Co., Philadelphia; David Jones, O. Barnett Foundry Co., Newark, N. J.; W. A. Jenkins, Olds Motor Works, Lansing, Mich.; A. H. Jameson, Mall. Iron Fittings Co., Branford, Conn.; A. J. Jameson, Falcon Bronze Works, Wilkes Barre, Pa.; Wm. E. Jackson, Abram Cox Stove Co., Philadelphia; Geo. H. Jefferis, Pusey-Jones Co., Wilmington, Del.; J. Parker Jefferis, Pusey-Jones Co., Wilmington, Del.; S. T. Johnston, S. Obermayer Co., Chicago; J. M. Jaycox, E. Law & Co., Philadelphia; F. D. Jacobs, Osborn Mfg. Co., Cleveland; C. V. Jacobs, The Osborn Mfg. Co., Cleveland; J. Henry Julian, J. W. Paxson Co., Philadelphia; A. Jimenez, Ph. Bonvillain & E. Ronceray, Paris, France.

KITTINGER, D. M., Pencoyd Iron Works, Philadelphia; W. B. Kennedy, Bethlehem Steel Co., Philadelphia; Earl S. Kulp, North Wales Machine Co., North Wales, Pa.; John Knickerbocker, Eddy Valve Co., Troy, N. Y.; J. G. Kasjens, Brass Foundry & Heating Co., Peoria, Ill.; J. C. Knoeppel, Belmont, N. Y.; Geo. Klaila, C. E. Mills Co., Syracuse, N. Y.; Fred Koch, Fairmount Foundry Co., Philadelphia; F. De Forest Kemp, Kemp Brass & Bronze Co., Troy, N. Y.; A. W. Kendrick,



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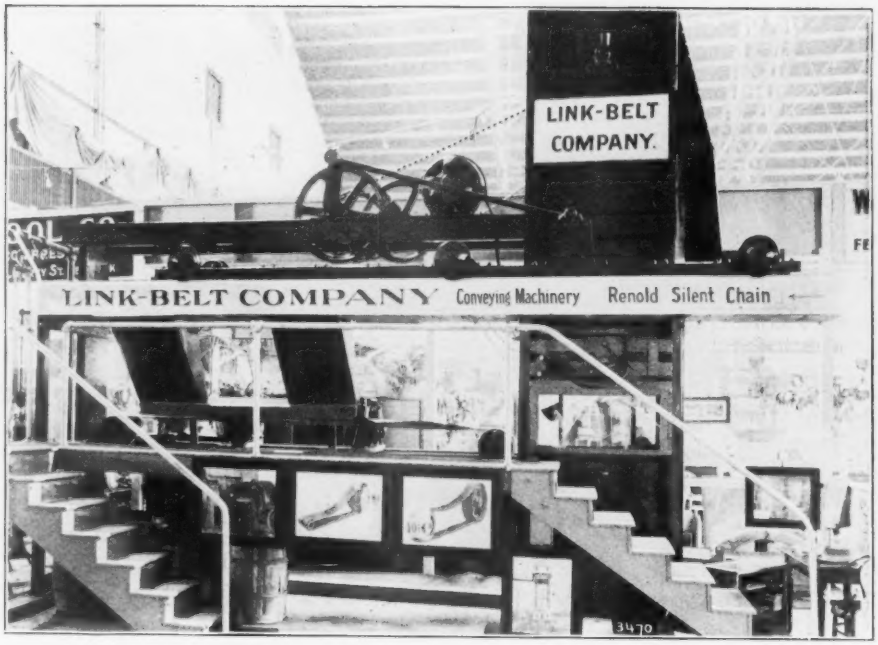

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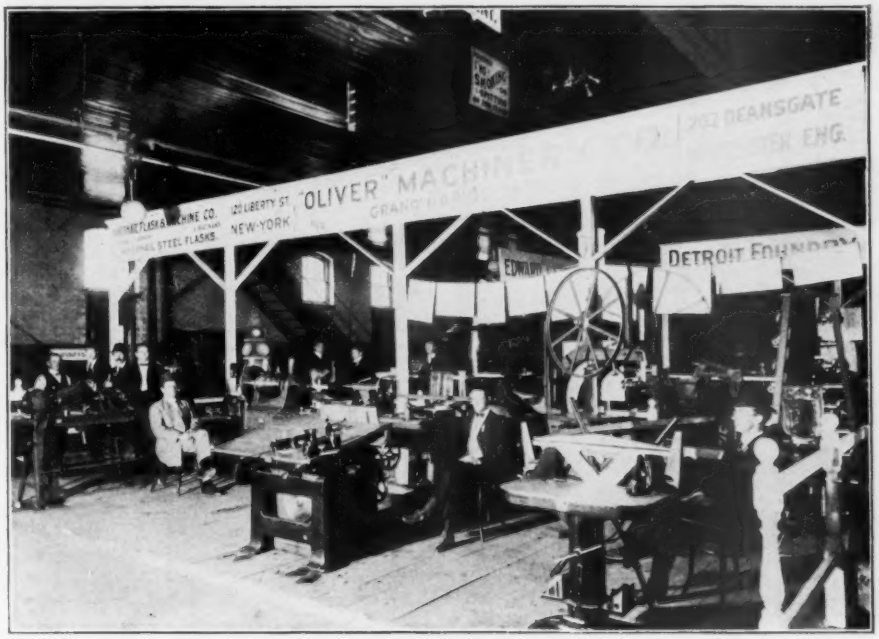

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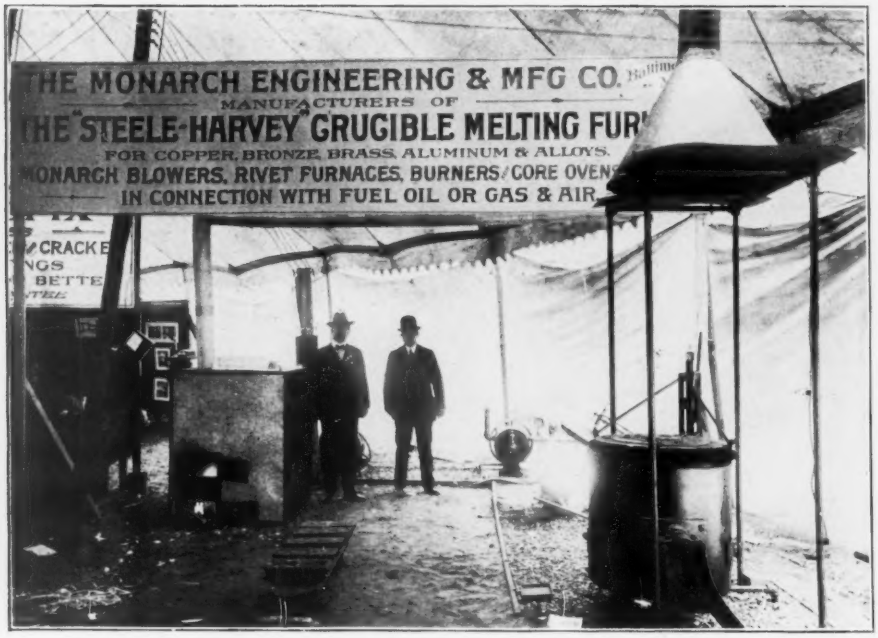
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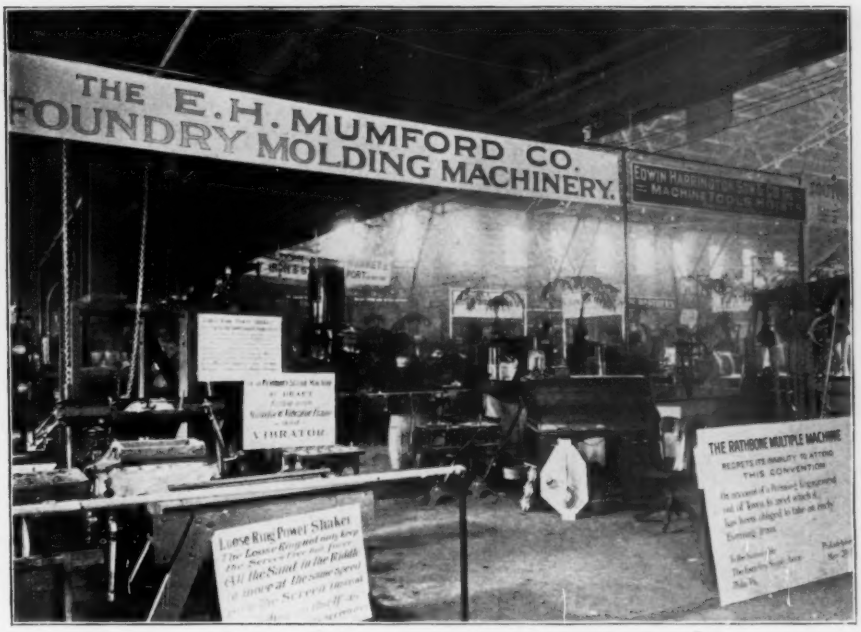

EXHIBITS—E. H. MUMFORD CO. AND EDWIN HARRINGTON, SON & CO., INC.

Co., Philadelphia; Josiah Thompson, J. Thompson & Co., Philadelphia; Edw. C. Thompson, J. Thompson & Co., Philadelphia; H. L. Tripple, The Fairbanks Co., Philadelphia; W. J. Thomson, Hamilton Facing Mill Co., Ltd., Hamilton, Ont.; H. V. Tyrrell, *Canadian Machinery & Mfg. News*, Toronto, Can.; J. S. Taylor, Paris Plow Co., Paris, Ont.; A. N. Thompson, Link-Belt Co., Chicago; U. Taylor, Robert Taylor & Son, Paterson, N. J.; G. M. Thrasher Jr., Western Tube Co., Kewanee, Ill.; A. H. Tallman, J. N. Tallman & Sons, Hamilton, Can.; James H. Tuttle, S. Cheney & Son, Manlius, N. Y.; A. Tropenas, Paris, France.

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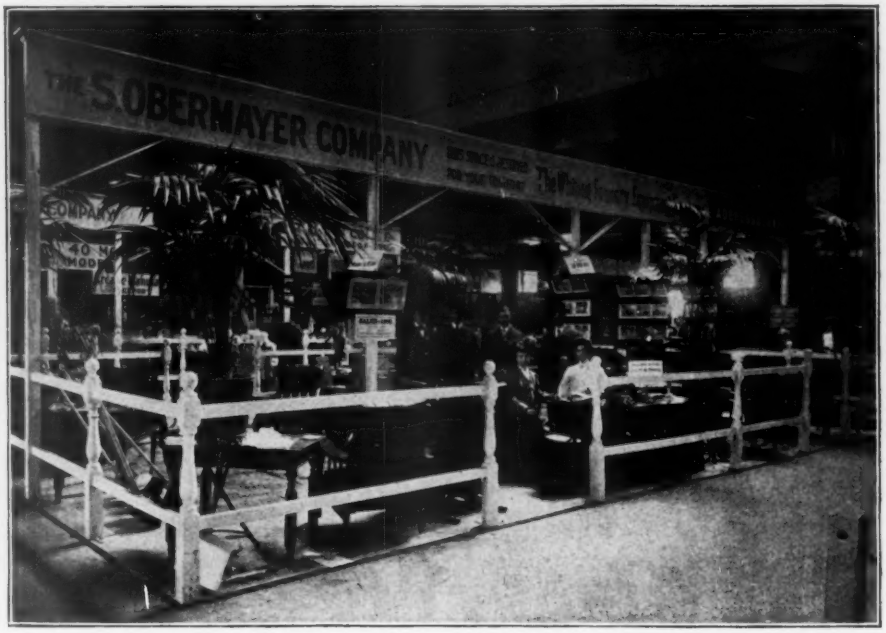


EXHIBITS—S. OBERMAYER CO., WHITING FOUNDRY EQUIPMENT CO., AND ADDRESSOGRAPH CO.

Jr., Falls Rivet & Machine Co., Cuyahoga Falls, O.; S. B. Wills, E. E. Brown Co., Lebanon, Pa.; J. R. Webster, C. E. Mills Oil Co., Syracuse, N. Y.; Walter Wood, R. D. Wood & Co., Philadelphia; C. J. Wiltshire, General Electric Co., Schenectady, N. Y.; Chas. Weihe, Connellsville Mfg. & Mine Supply Co., Connellsville, Pa.; Isaac Wood, U. S. Graphite Co., Saginaw, Mich.; T. H. Williams, U. S. Graphite Co., Saginaw, Mich.; W. Fred Wood, N. Y. Air Brake Co., Watertown, N. Y.; J. T. Whitehouse, Bonney-Floyd Co., Columbus, O.; S. E. Winslow, Ashcroft Mfg. Co., Bridgeport, Conn.: F. E. Wheeler, International Heater Co., Utica, N. Y.; A. H. Warner, Millett Core Oven Co., Springfield, Mass.; A. Weston, Vickers Sons & Maxim, Ltd., Barrow-in-Furness, England.

YAGLE, Wm., Yagle Foundry & Machine Co., Pittsburg; James Young, Penna. R. R. Co., Altoona, Pa.; R. H. York, Berkshire Mfg. Co., Cleveland; Henry W. Yost, Thomas Roberts Stevenson Co., Philadelphia; Wm. Yellowley, Canadian Locomotive Co., Kingston, Ont.

ZWING, E. M., E. H. Mumford Co., Philadelphia; O. Zentgraf, South Baltimore Steel Car & Foundry Co., Baltimore; Henry H. Zilm, Underwriters' Association, Philadelphia; F. H. Zimmers, Union Foundry & Machine Co., Pittsburg.

INSTRUCTION PAPERS IN FOUNDRY PRACTICE.

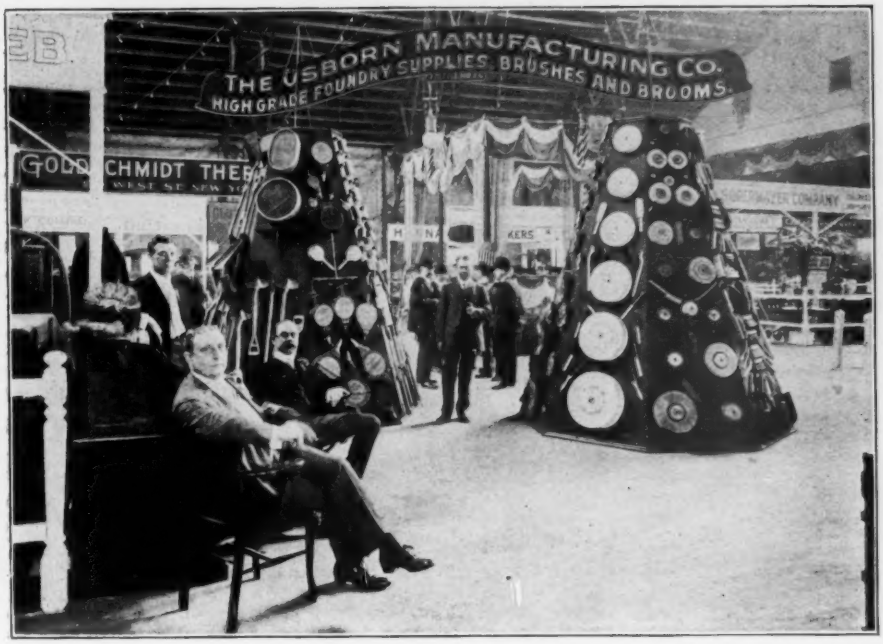
W. W. McCarter, Marietta, Ga., who presented a most interesting paper entitled "Some Facts Concerning Trade Schools," at the recent convention of the American Foundrymen's Association, will forward instruction papers for a period of twelve months at the price of $12 for each apprentice, provided, however, that a sufficient number of students will be enrolled to warrant him in proceeding along this line. The school he is now conducting has been unusually successful and practical men are being graduated from his shop.

ELECTION OF OFFICERS BY THE NEW YORK FOUNDRY FOREMEN.

At the annual meeting of the New York branch of the Associated Foundry Foremen, officers were elected as follows: Hugh McPhee, president; D. C. Wilson, vice president; J. C. Pangborn, secretary and treasurer. Mr. Pangborn succeeds Mr. McQuillin, who recently accepted a position at Warren, Pa.

REQUEST FOR CATALOGS.

Vve Henri Vandamme, Rue du Luxembourg, Roubaix, France, would like to receive catalogs and pamphlets descriptive of foundry equipment and appliances from American manufacturers.



EXHIBIT—OSBORN MFG. CO.

ELECTRO-DEPOSITION OF BRASS*

CHAS. H. PROCTOR

NOT SINCE the French Syndicate controlled the copper market of the world, more than 20 years ago, has copper reached such an intrinsic value as it has today. This is not due to any combination of labor or capital, but to natural results of supply and demand.

When we take into consideration the unprecedented demand for copper created by the vast changes that are taking place in the great motive power systems of this country—and we might just as well say of the civilized world—from steam to electricity, and the tremendous amount of copper consumed in these changes, it is not necessary to go very deeply into details to form an opinion as to why copper has reached the high price at which it now stands.

The high price of copper has had such an effect on the brass industry of the world that in many lines of manufacture, which have usually been made of brass or a similar alloy, that metal has been replaced with the ferrous and non-ferrous metals of iron, steel, tin; and with alloys of lead, antimony, spelter and combinations of these metals. In fact, wherever possible the baser metals have been used to cheapen the cost of production.

So we find the results of the workers of iron and brass in the finished product. The electro-plater, by his art, unites the craft into one common mass, and so it should be with this great brotherhood of workers in iron and brass. The electro-plater, on the common level, congratulates you upon this endeavor to unite your efforts and bids you "God speed."

In preparing this paper for your consideration it is with the one idea to present a few practical suggestions on the electro-deposition of brass upon baser

*Presented at the Philadelphia convention of the American Foundrymen's Association.

EXHIBIT—THOMAS W. PANGBORN CO.

metals, as I have found them in actual practice. As brass consists essentially of an alloy of 2 parts of copper to 1 of zinc, so we should expect that for the same alloy in the electro-depositing of brass the same essential proportions would be necessary to produce like results. But in making a careful study of this question in practice I have found that to produce like results from a two-and-one mixture it is necessary to use 3 parts of copper to 1 of zinc for the deposited alloy.

Of the various metallic deposits now employed by the plater there is none that gives so much trouble and needs such careful treatment, for good results, as the brass bath, and this is the consensus of opinion of nearly all platers. While this may be true in many cases, in my own practice I have found the brass bath as easy to keep in working condition as copper or nickel, silver or gold. There is one thing important for successful results in brass plating—that is a study of the alloys of copper and zinc to understand the variation of color resulting from the increase or decrease of the amount of copper employed. In the alloy of the foundry the two-and-one mixture produces the full yellow or rich brass. This color is produced with slight variation even when 80 parts of copper and 20 parts of zinc are used. When we go below the two-and-one mixture, even as low as equal parts of each metal, we find the yellow color still predominates. This variation of color in proportion to the mixture of the alloy is well understood by the brass foundryman, but to many of the electro-platers is an unknown quantity, and this is where the trouble comes in. It is not always the effect of too much cyanide, too much ammonia, or a too concentrated or an insufficiently dense bath, but to an excess of zinc that causes the trouble. This is shown by excessive spotting out, easily tarnished deposits, or deposits that materially change their color when lacquered, for which the plater endeavors to find a remedy.

In the study of alloys, as mentioned, those below the two-and-one mixture, yellow colors, still predominate. As an example: Today the brass bath is normal; work has been accomplished all

EXHIBIT—WILBRAHAM-GREEN BLOWER CO., J. W. PAXSON CO.'S SECTION

day with satisfactory results. Tomorrow a slight variation of color is noted with a tendency toward a slight reddish yellow. In nine cases out of ten an addition of zinc will be made when, according to the study of the alloys, copper should be added to reimburse the loss noted by the change in color. When it is remembered that copper is essentially the great factor in a well composed brass bath, which consists largely of this metal, and that zinc is withdrawn very slowly, the bath should be regulated with copper.

In the composition of brass baths there is very little change from the formulas prescribed by the great master Roseleur, whose directions stand pre-eminently above others in their successful working. This applies not only to brass solutions, but to nearly all metals that are employed in the art of electro deposition.

It is not necessary for me to go into details of formulas, for all platers know that a brass bath consists mainly of the carbonates of copper and zinc in their solvent of cyanide of potassium, with the additions of the sodium carbonate and bisulphite of soda as conducting salts to increase the electrical conductivity; there are also slight additions of ammonia to assist in maintaining color.

Some operators use anodes of copper constantly in their baths, adding zinc when necessary to maintain color. This is good practice, for with an anode surface of all copper the plater can make no mistakes as to the metal necessary to produce the desired color. In my own practice I use anodes of cast copper and zinc in the proportion of 3 anodes of copper to 1 of zinc. In this manner I find it possible to easily maintain a uniform deposit by the addition of cyanide and the soda salts, with occasionally an addition of the metallic salts. A slight amount of zinc dissolved in ammonia water, thrown towards the copper, will instantly change the color of the deposit.

I have stated that in the composition of brass baths there is nothing new; but I have in mind one compound that has appeared within the past year or two. I refer to cuprous sulphite or

EXHIBIT—HENRY E. PRIDMORE

red copper compound, which is rapidly replacing the acetate and carbonate of copper in the production of deposits of copper, bronze and brass. The results obtained with this compound have been eminently satisfactory. Its use avoids to a large extent the trouble experienced in plating iron, in the nature of blistering. It also does away with this trouble in the deposits upon lead and its alloys.

A standard solution that can be made the basis of a copper, bronze or brass bath consists of:

Water	1	gallon
Cyanide of potassium	6	ounces
Cuprous sulphite	2½	"
Sodium bisulphite	2½	"

For the production of bronze or brass by this formula, carbonate of zinc is dissolved in cyanide of potassium and water in the proportion of one part carbonate to two parts cyanide, making a concentrated solution. By adding one-eighth part of the amount of cuprous sulphite used, a bronze bath will be the result; with the addition of one-fourth part a good brass bath will be obtained.

It will always be found more satisfactory, when producing deposits of alloys, to first prepare the copper bath, and then make the additions of zinc when the bath is in working condition.

SOFT BRONZE MIXTURES.

C. VICKERS

Question:—Will you kindly give us a soft bronze mixture for small valves, together with a good flux for the same?

Answer:—(1) Copper, 64 pounds; tin, 4 pounds; zinc, 3 pounds; lead, 1½ pounds.

(2) Copper, 64 pounds; tin, 2 pounds; zinc, 6 pounds; lead, 2 pounds.

Common salt is as good a flux for brass as anything that can be used. It must be put in when the pot is charged, a small handful being sufficient. It does no harm in a larger quantity, but emits suffocating fumes when pouring. Charcoal should always be used, no matter what the other flux is that is used with it. Another good cover for brass is glass. The three articles mentioned may be used alone or combined.

EXHIBIT—RANDALL TRAMRAIL CO.

THE ART OF GALVANIZING*

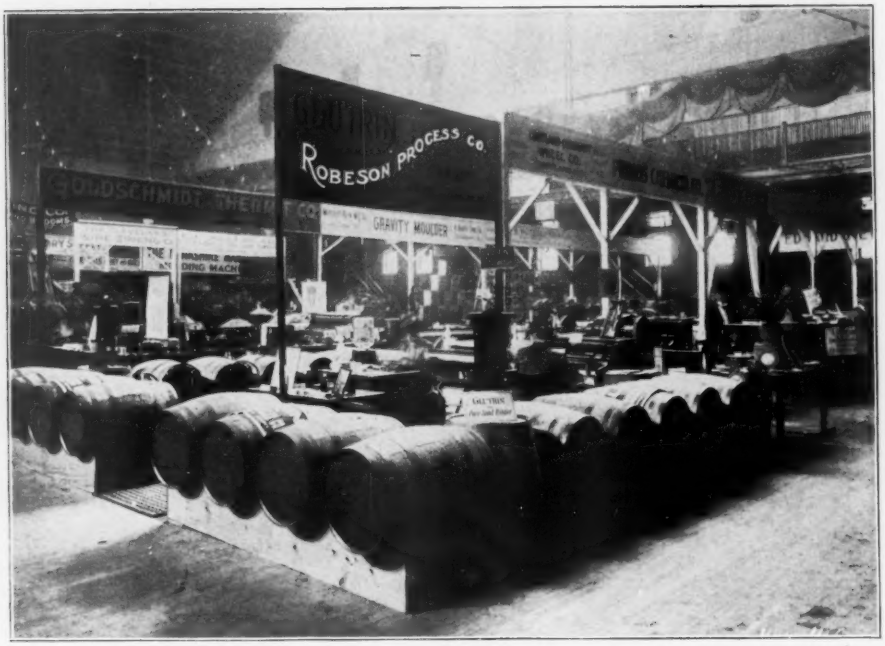
ALFRED SANG

ONE OF the most persistent problems which confront the worker in iron and steel is the prevention of corrosion. We cannot rid ourselves of the agents which effect the corrosion of iron without at the same time ridding ourselves of the agents which are essential to life itself. Air is indispensable both to human respiration and for the formation of rust and other oxides for which it supplies the oxygen; moisture is necessary for the formation of clouds which make the earth fertile, and it also supplies the medium in which rusting takes place and hydrates the oxide; carbonic dioxide is an animal by-product and a raw material for the vegetable world, and the exchange of carbonic dioxide and oxygen, which is continually taking place between the animal and vegetable kingdoms is of vital importance; then, on the other hand, rust is not readily formed—if at all—unless there be an acid present, and the acid which is most universally distributed is carbonic acid or hydrated carbonic dioxide. There is, as you see, a close relationship between the processes of living and rusting, but while human beings make up for the rusting or decaying of their tissues by nutrition, it has not yet been discovered how to feed or regenerate iron, and until such a discovery is made we are compelled to take our cue from the ancient Egyptians and resort to embalming.

Methods for Protecting Iron and Steel.

There are two general ways of embalming iron to prevent its decomposition, which might be called respectively the non-metallic and metallic methods. In the non-metallic method, the articles are coated with an organic substance, usually oil or varnish, the efficiency of which depends on its being more or less air tight; when coloring matter is added to the oil it becomes a paint, but I understand from authorities on the subject that a varnish free from pigments is preferable to anything else. The metallic method consists in coating the

*Presented at the Philadelphia convention of the American Foundrymen's Association.



EXHIBITS—ROBESON PROCESS CO., CORTLAND CORUNDUM WHEEL CO., PRIMOS CHEMICAL CO., AND SMYTH, SWOBODA & CO.

iron with some other metal, and it is this method which I have come to discuss with you.

The Composite Nature of Steel.

Iron rusts less readily than does steel; this is perhaps due to steel being a very composite material. In the iron, which forms the bulk of its composition, are dissolved or immersed a great variety of other substances; some of these are simple, such as graphite, silicon and manganese, and others are compound, such as carbides, sulphides, phosphides and silicides; the carbon compounds are very numerous and diversified, being due to different heat treatments; the best known are cementite, pearlite and martensite. Just as variety is, to some people, the spice of living, so is heterogeneous composition the spice of rusting, in the present instance at any rate; nor is this by any means a solitary instance; it is a well known fact that chemically pure zinc is dissolved very slowly by certain acids, whereas the commercial product, especially if it be high in iron, is rapidly dissolved.*

When steel is attacked by an acid pickle its surface is due to the iron dissolving first and the impurities being left as a poorly adhering black powder. For some work which has to be coated, and especially if the coating is non-metallic, it is desirable to remove the surface "rottenness" by means of the sand-blast; the sand-blast is often inconvenient or undesirable, but a high pressure water jet is also effective and will remove at the same time the gelatinous or colloidal salts of iron which are left on the surface of the steel.

Metallic Coatings.

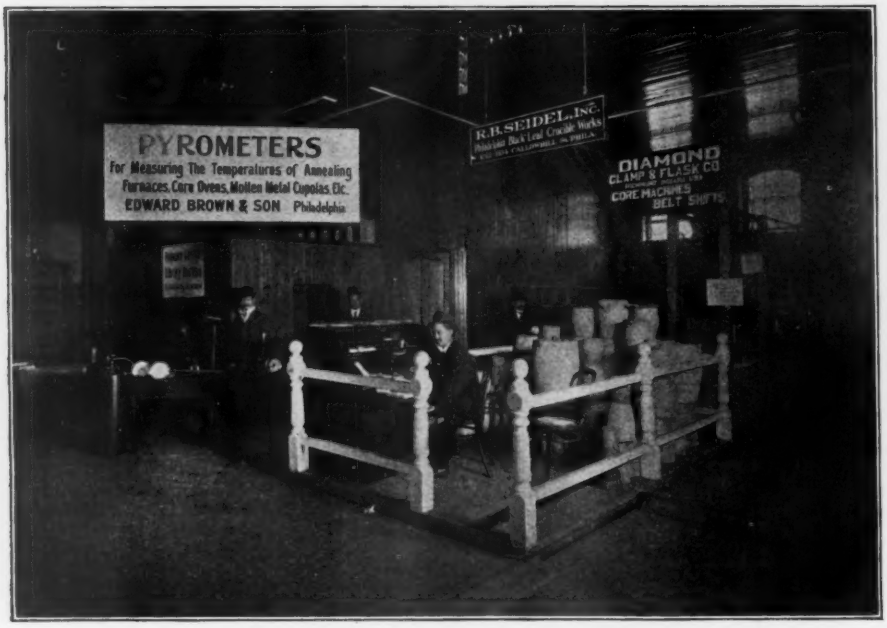
If the metallic coating is considered merely as a garment which protects the iron article from atmospheric influences, the points which must receive special consideration are the clōseness of the fit and the impenetrable qualities of the coating. A close fit is more readily obtained by depositing the metals electrically. In hot processes the uneven contraction of the coating and coated met-

* The theory has been advanced by Weeren that this passiveness of pure zinc is due to the formation of a condensed layer of hydrogen on the surface, which prevents further action of the acid. It is difficult to see how the presence of iron would prevent the accumulation of hydrogen.

EXHIBIT—ROCKWELL ENGINEERING CO.

als—the latter usually having the lower coefficient—will cause blisters which are not always noticeable to the naked eye but which are none the less present. This poor adherence due to uneven contraction is evidenced by the flaking which will take place when the articles are bent; with articles which do not undergo bending, such as castings, there may not be any flaking, but the air spaces are there just the same and oxidation will take place under the blisters, out of sight, slowly but surely, if the air is given access. Unfortunately the air has free access to these spaces because no hot coated surface which has not received a mechanical treatment in the hot state, such as rolling, is free from faults and crevices; especially is this the case in rough and irregular work like castings where the variety of strains taking place at the moment of setting of the coating metal produce an equivalent variety of microscopical fissures. Through these fissures the air, moisture and carbonic dioxide have free access to the iron.

An electrically deposited coating adheres a great deal better than does a hot coating, and this is the greatest point in its favor; unfortunately, it is almost impossible to obtain a surface free from pores. Every photographer knows how specks of dust will cause pinholes in his negatives; a particle of dust is more or less light-proof and protects the point of the film on which it rests from the chemical action of light. In electrolytic work each speck of impurity prevents the metal-ions of the electrolyte from depositing on the spot covered by the impurity and a pinhole or pore is the result. These pinholes are like wells with a spot of rust, a speck of dirt or a particle of oil at the bottom, each of which is sufficient in itself to prevent the deposition of the coating metal, but none of which is able to prevent the access of the corroding agencies. Under the microscope rust will be found to originate in all cases in the pores, and I have examined specimens where the rust seemed to fairly ooze out of them. If articles could be made perfectly clean before being coated, the electrolytic process would be perfect as regards the two points of quality required of a coating considered as a covering only.



EXHIBITS—R. B. SEIDEL, INC., EDWARD BROWN & SON, AND DIAMOND CLAMP & FLASK CO.

The Coating as a Mechanical Protection.

Considered merely as a mechanical protection, the coating should be resistant to impact and to abrasion, the latter being the most important. The soft metals, such as tin and zinc, do not stand up well against abrasion, but unless their adherence be very defective, they will stand impact well, on account of their malleability at ordinary temperatures. It would be desirable to obtain a coating which would be as good a protection as zinc but tougher and harder. Aluminum is being used with some success and if the metal were cheaper it would become an interesting competitor of zinc.

Different Behavior of Tin Plate and Galvanized Iron.

But there is a more important feature of metallic coatings to be taken into consideration. This feature I shall introduce by the following example: If you make an incision in the surface of a sheet of tinplate and a similar one in a sheet of galvanized iron and expose the two sheets together to the same oxidizing agencies, you will soon note a very great difference in the behavior of the two mutilations. The cut in the galvanized iron will rust very slightly or not at all and the zinc at the edges will be oxidized, but the cut in the tinplate will not only show much more rapid and intense oxidation of the iron but the corrosion will extend beyond the edges of the cut, and in spite of the tin. A pinhole in a galvanized sheet will not rust; a pinhole in a tinplate will spread out like a star.

Metals in Contact.

I must now call your attention to a few scientific principles which are all-important when considering metallic coatings. In order to understand the reason for the different behavior of the galvanized iron and the tin-plate, it is necessary to thoroughly understand what takes place when two metals are in contact. For the purpose of the present discussion we must consider four cases of metals in contact as follows:

First—In the presence of electricity.

Second—In the presence of heat.

Third—In the presence of corrosive agents.

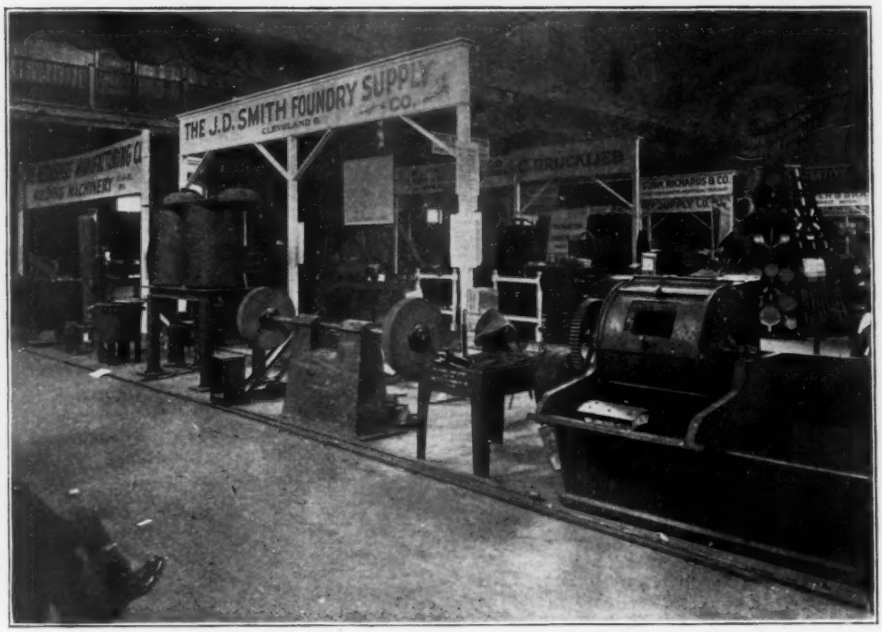
Fourth—Apart from any exterior agency whatever.

EXHIBIT—W. W. SLY MFG. CO.

In the Presence of Electricity.

As regards the first case, it is important to note that copper conducts electricity better than does iron, iron better than tin, tin better than lead, lead better than zinc and zinc better than antimony. The metals first mentioned are negative to those which follow; iron is negative in relation to zinc and zinc is positive in relation to iron. The conductivities of these metals are the reciprocals of their resistivities, in other words, the better conductivity of copper over iron is due to the smaller resistance which it opposes to the passage of the electric current. Again, the better the metal conducts electricity the less capacity it has for storing it; this is the same as in the case of heat, the poorer the body as a conductor, the more difficult it will be to heat it, but the longer it will take to cool. The wooden handle of a silver teapot does not heat up as well or as rapidly as does the pot itself, but when the teapot is cooled the metal part cools quickest and becomes colder than the handle. If, now, two metals, say iron and zinc, are put in contact and immersed in an electrically charged medium, the iron being the better conductor will not absorb as much electricity as the zinc, and there will exist what is known as an electromotive difference of potential, there will be a difference of electrical pressure between the iron and the zinc in contact, and therefore a steady current of electricity will flow from the zinc to the iron, and this current will be kept steady by the leakage which is directly proportional to the absorbing power. If no leakage were possible the potential of the two metals would reach the same level and they would be in electrostatic equilibrium equivalent to a closed circuit.

An apt comparison to what takes place would be that of two water tanks of equal dimensions, connected at the bottom and at the top by open pipes, and one tank having a larger intake at the top than the other; if both tanks are filled simultaneously by steady streams of water, the tank with the larger intake will fill more rapidly and there will be a continual flow through the lower connecting pipe from the tank with the larger intake to the tank with the smaller intake to maintain the level. When the tanks are full they will be in equilibrium, and if they are turned upside down the outflow through the intake pipes will be



EXHIBIT—J. D. SMITH FOUNDRY SUPPLY CO.

proportionate to the previous inflow and the current will be reversed, passing from the tank with the smaller outflow to the tank with the large outflow in which the level is going down more rapidly. It is this operation of maintaining, or rather the effort to maintain the electrical level which produces the flow between metals of different conductivity when they are in contact and immersed in an electrically charged medium. The medium itself may be perfectly static, or at rest, but the flow from the iron to the copper will manifest itself as dynamic, or moving electricity; nothing in nature, be it material or immaterial, can be manifested to our senses unless there be a motion, a difference, a relation.

Electricity is always present on this planet, and everything is fairly impregnated with it, if, therefore, we bring two dissimilar metals into mutual contact we shall obtain a flow of electricity from one to the other, caused by an ineffectual effort to equalize potentials, which will produce sensible galvanic effects. The contact need not be direct; a suitable conducting connection, such as moist air, will act as an electrolyte and enable the action to take place, the space in between constituting what is known as a field of force. Besides atmospheric and telluric electricity we are often called upon to take into consideration, in our engineering problems, the electricity artificially produced for industrial and domestic purposes, the diffusion of which, or "stray currents" as they are called, will hasten the corrosion of water pipes and structural steel, even when they are embedded in concrete.

The reverse of the order in which I have previously placed the metals in relation to their conductivities—i. e., antimony, zinc, lead, tin, iron and copper, indicates the positive direction in which the current will flow from metals having the higher to those having the lower potentials; it is known as an electromotive series.

In the Presence of Heat.

The second case is that of metals in contact exposed to heat. The electrical conductivity of substances will vary with temperature, that of metals decreasing with an increase of temperature. There are notable exceptions to any generalization which might be attempted that the conductivity is inversely proportional to the temperature, and one of these exceptions happens to be iron.

When two metals in contact are sub-

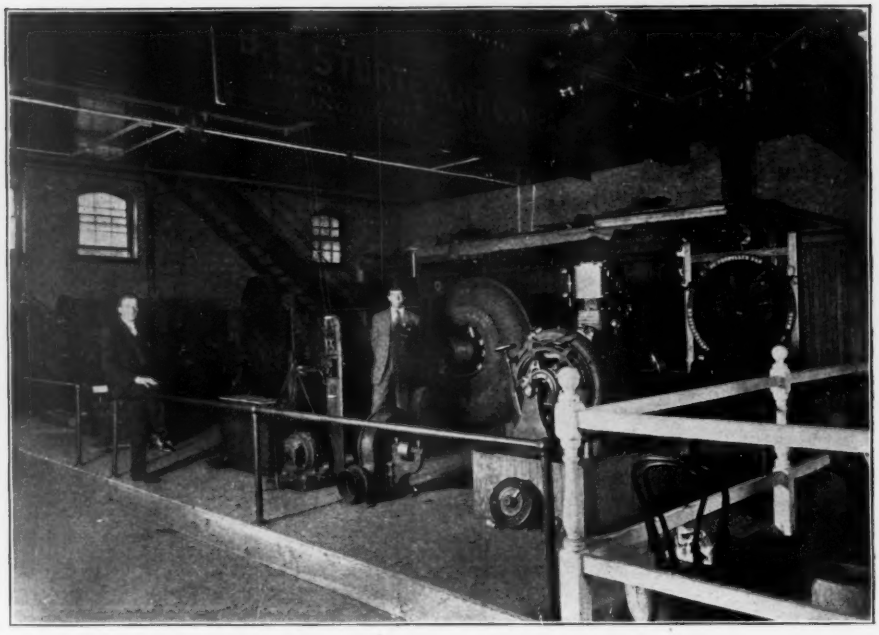
EXHIBIT—STANDARD SAND AND MACHINE CO.

jected to heat the voltaic or galvanic action of which I have spoken will be influenced either favorably or unfavorably because the thermo-electric series is different from the electro-motive series which I have given you. The thermo-electric series runs as follows: lead, tin, copper, zinc, iron and antimony. The order of these metals indicates the direction in which the current tends to flow with an increase of temperature, this tendency may be, and is in most cases, exhibited as either a resistance or as an aid to the electromotive current; for instance, increase in temperature will reduce the current from zinc to iron in a lesser degree than from antimony to iron. This principle has been used in the construction of electric pyrometers in which the variation in the temperature of a couple formed of dissimilar metals is recorded very sensitively at a distance from the source of heat, by means of a galvanometer.

The galvanic effect between metals is, therefore, modified in a very complicated manner and to a considerable extent by the temperature at the point of contact. This galvanic action seems to be intimately related to the natural tendency towards chemical action exhibited by all substances in contact and to that chemical affinity which exists to some degree or other between all kinds of matter.

In the Presence of Corrosive Agents.

The third case is that in which corrosive agents are present which attack both of the metals. A decrease of electrical potential seems to aid chemical action and an increase of this potential opposes it. The metal towards which the flow of current is directed is, so to speak, over-saturated on account of the persistence of effect which, when it refers to magnetism is called hysteresis, and its potential is greater than normal. The flow of current from zinc to iron will over-saturate the iron and will prevent its decomposition, when it is exposed to corrosive influences, whereas the zinc which is under-saturated is in poor physical condition to withstand chemical attacks. It will decompose into oxide and carborate more rapidly than if it were out of contact with the iron. If only one of the metals is attacked by the corrosive agents under normal conditions, there will be no galvanic protection and this is why nickel-plating which is unaffected by ordinary atmospheric conditions is nothing more than a protective skin and if it is partially removed the



EXHIBIT—B. F. STURTEVANT CO.

exposed surface of the irons rust very readily. Copper-plating is no better, and if the iron is exposed the galvanic action is slightly unfavorable because the copper is in negative relation to the iron. Copper rolled over iron and then drawn, forms a good protection, but in this case the iron is nothing but a core. Lead would be a good coating metal if it were only harder and more readily attacked by acids.

Apart From Any Outside Agents.

The fourth and last case is that of metals in contact without any exterior agents being taken into account. Careful investigation has shown conclusively that if two metals are placed in close contact there will be a slow exchange of molecules, which will result in the metals alloying at their surface. If great pressure is applied during this exchange, the metals may be actually welded together. This action does not take place in a minute, nor even in a day or a month. It is very wonderful what pressure will do; certain salts in a finely powdered state have been compressed beyond a critical point where the cohesion became equal to that of the substance before it was pulverized and even transparency was recovered. What enormous power must exist within the atom to bring about the same results by rapid and unimpressive reaction; such as the recovery of crystals by dissolving a pulverized substance and then evaporating it.

This exchange of molecules between metals in contact is a simple case of diffusion. The diffusion of metals takes a great deal longer than that of liquids or gases because the internal friction is vastly greater; if the molecular cohesion is reduced by fusing the metals, the alloying will take place as readily as when whisky and water are mixed to form the alloy, which is known as a "high-ball." If the metals could be brought to a state of vapor, the diffusion would be practically instantaneous, and even if only one of the metals were in a state of vapor this should hasten the process to a considerable extent. I must ask you to take good note of this statement, because it has a very important bearing on the process and nature of dry galvanizing.

The effect of pressure is to hasten the action, but diffusion will always take place between metals provided there is some kind of contact. According to this theory the metals of alloys should become more thoroughly incorporated with time, and a zinc coating which has passed

EXHIBITS—TABOR MFG. CO. AND J. S. MCCORMICK CO.

through the early stages of its existence without being destroyed should, like wine and love, improve with age; the two metals should gradually become alloyed at their surface of separation. If the old Ninivites or Egyptians had produced galvanized work there would be people to worry over the lost art of alloying iron and zinc just as others still persist in claiming that some useless art of hardening brass has been lost, although it has not even been proved as yet that it ever existed.

Specifications For an Ideal Coating.

On looking back at the four cases of metals in contact which I have discussed, you will readily see that all are closely related and that they must in all normal cases be present at one and the same time. What then are the specifications for an ideal metallic coating for iron?

First—It must be as far as possible from iron towards the positive end of the electromotive series and must fulfill the same requirements in the thermo-electric series.

Second—It must be affected by the same agents which corrode the iron.

Third—It must present as large a surface as possible to the corroding agents.

Fourth—It must be in very close contact with the iron.

Zinc is, of all the commercial metals, the one which most closely fulfills the first and second requirements; the third and fourth in regard to surface exposed and contact with the iron, are matters of process, and I shall, therefore, now proceed to describe the various processes which have been used to apply zinc to metal surfaces, but before doing so I want to point out that all these principles which I have enumerated apply as well to the salts of the metals and that is undoubtedly one reason why red lead and zinc white give such good protection against corrosion.

Cold Galvanizing.

In the early years of the last century the process of electrolytic zincing, which is nowdays known as cold or electro-galvanizing, was first discovered, but until about 10 years ago the lack of suitable equipment prevented its commercial application. The articles to be treated by this process are first thoroughly cleaned of scale, rust and grease by an acid pickle, sand-blasting, hot lye or by other means, singly or in combination, and are then placed as cathodes in a solution of

EXHIBIT—UNITED STATES GRAPHITE CO.

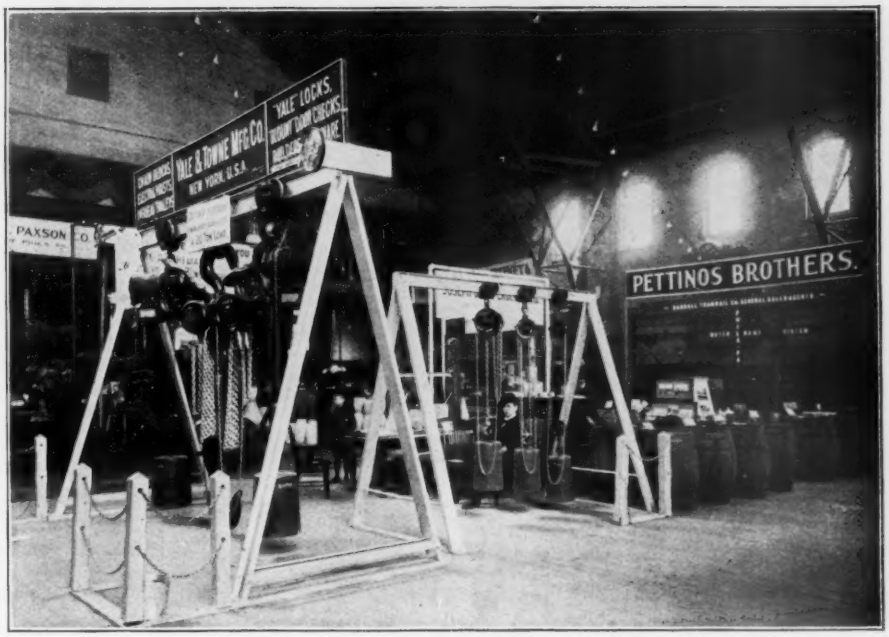
some salt of zinc—usually the sulphate—in presence of zinc and which regenerate the solution, while a current of low voltage is passed through the arrangement and deposits zinc from the solution upon the articles. Numerous factors must be taken into account; the composition and temperature of the bath; the voltage and density of the current; the quality, shape and position of the anodes, and many other points which are all of prime importance if the results are to escape first criticism and then corrosion.

The surface of an electrically galvanized article is matt or frosted, provided the work has been properly done. It always shows a few pores. If improperly done, or if the work was not perfectly clean before treatment it is either honeycombed with pin holes or spongy. Above a certain limit of thickness, below which the coating is worthless, first class electro-galvanizing is superior to hot-galvanizing and it is cheaper to produce where automatic machinery can be employed, although less zinc is deposited than by a hot dip. This is no doubt due to the better contact between the zinc and iron.

Hot Galvanizing.

Sixty years ago the process of hot-galvanizing was introduced on a commercial scale. It consists in dipping the articles into a bath of molten spelter, with or without other metallic additions, at temperatures ranging from 750 to 900 degrees Fahr. The articles must be first cleaned as for electrolytic work, but a slight falling short of perfection does not have such disastrous effects on the quality of the result. Very heavy pieces may be heated before dipping so as not to chill the bath. The coating is crystalline or amorphous and does not adhere as perfectly as does the electrolytic one. Properly treated sheet metal goods have an attractive spangled appearance but most articles look like castings and sharp edges are lost. Metallic chlorides are used as fluxes, they are expected to remove the injurious salts of iron left by the pickling, but it is a question if it is not another case like the introduction of rabbits in Australia, and if they themselves are not the main cause of the decay which starts underneath the coating in hot-galvanizing work.*

* The fumes given off in hot work are injurious to machinery and in a manufacturing concern it is necessary to erect a separate building for this work.



EXHIBITS—YALE & TOWNE MFG. CO. AND PETTINOS BROS.

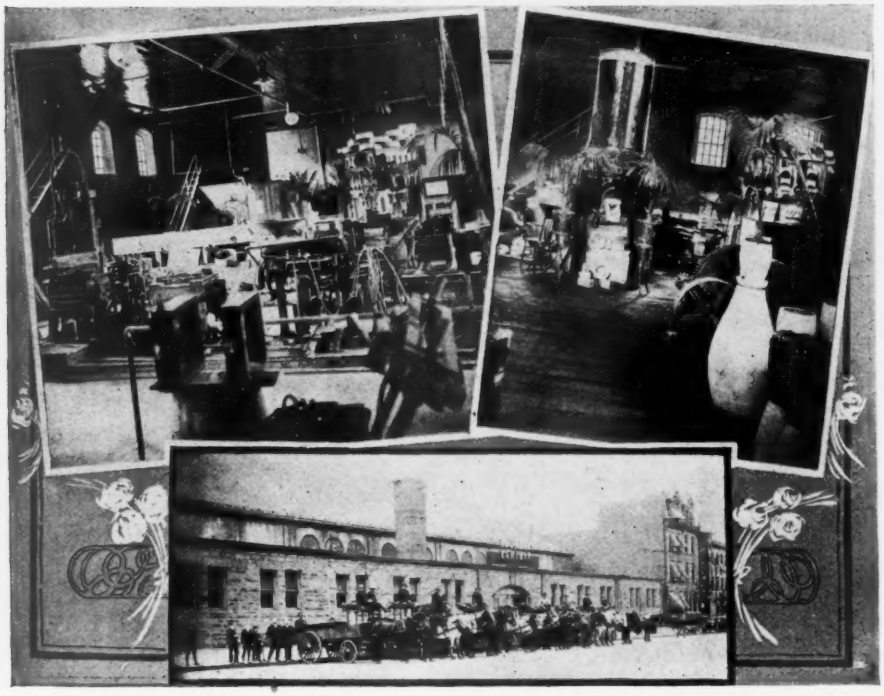
Dry Galvanizing.

The latest process for applying a zinc coating, is the dry process, and I am going to endeavor, not only to describe the process itself, but to show you also how it fulfills the requirements which I have indicated, how it permits the extension of galvanizing to articles which have never been protected in this manner and how by divulging the mystery of the nature of zinc dust it permits us to speculate along new lines in metallurgy which may lead to the discovery of some principles of great industrial value.

The process of dry galvanizing or Sherardizing metals was awarded a gold medal at the St. Louis exposition of 1904 and the president's gold medal for 1905 was presented to its discoverer by the British Society of Engineers. The inventor, Sherard Cowper-Coles, is one of the most eminent metallurgical engineers in Europe and is well known for his reintroduction on a commercial scale of the process of electric galvanizing, the regenerating of electrolytes by the coke and zinc dust filter, the electrolytic spinning of copper into sheets, wire and other forms, and innumerable other inventions and improvements in connection with the electro-deposition of metals.

The Practice of Dry Galvanizing.

For the purpose of Sherardizing, the articles are placed, after cleaning, in a retort—usually a drum—and are covered with zinc dust, which is commonly called blue-powder, and is the flue-dust, and, therefore, a by-product of the zinc smelting furnace known as the Belgian furnace. It contains as a rule from 75 to 90 per cent of pure zinc; the supply of zinc-dust is ample at a price below that of spelter, and if the demand increases it can be produced in any quantity that may be required. A small amount of powdered charcoal is added to prevent oxidation of the zinc by the air inside the retort at the beginning of the operation, and the receptacle is closed and heated to a temperature about two hundred degrees below the melting point of zinc. Ideal conditions would obtain if the air were exhausted from the drums. Where the size of the plant warrants the control of the zinc-dust consumption to within so fine a margin, the drums might be filled with some inert gas such as carbonic dioxide which is supplied to soda fountains and other uses in steel bottles at a very low cost. It is, however, to be feared that if the temperature is allowed to go too high the carbonic dioxide



SECTIONS OF J. W. PAXSON CO.'S EXHIBIT. PAXSON'S TEAMS ON PARADE

might act as an oxidizer on some of the dust.

By Sherardizing, a homogeneous deposit of zinc is obtained, varying in thickness according to the length of time the article is allowed to remain in the retort, its lower portion being an alloy of zinc and iron or of zinc and copper, as the case may be. In the case of copper the alloy is a true and hard brass. The drum is occasionally turned a fraction of a revolution to insure an even coating where the articles are crowded together, and the heating may last from a few minutes to several hours and two or three drums can be used in connection with one furnace.

A Sherardized surface resembles in general appearance an electrically coated surface. It is, however, of a soft silver-gray, more lustrous and metallic and, on that account, it is to most people, more pleasing to the eye, and it is distributed with great uniformity, which is not the case in hot galvanizing. Whereas in hot galvanizing the amount of zinc which is alloyed to the metal of the article is very small and most of the coating forms an exterior perishable skin, in Sherardizing the coating is thoroughly incorporated with the metal which it protects, forming an alloy having the appearance of pure zinc but much harder and more durable. It is on account of this thorough alloying that the protection afforded by Sherardizing is so superior to that afforded by either hot or electric galvanizing. The zinc having penetrated the iron, the old surface cannot be recovered by either chemical or mechanical means.

If an excessive amount of zinc is deposited by Sherardizing, the outside surface is composed of zinc somewhat hardened by the presence of a small percentage iron, and zinc-dust accumulates and clusters in a way which renders the surface rougher and much less attractive in appearance under magnification than it is to the naked eye. No special advantage is derived from the additional expense unless the conditions under which the articles are to be used are exceptionally severe.

The process of Sherardizing is not confined to zincing; the dusts of antimony and of other metals can be used in a

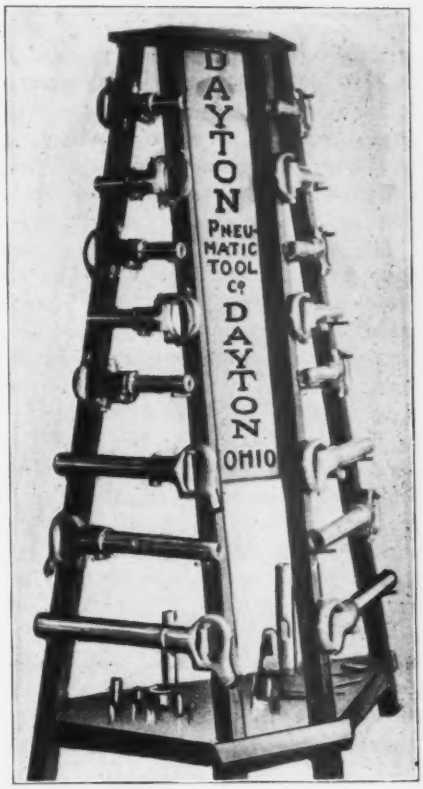
similar manner. The fact that zinc-dust, even at temperatures higher than its melting point, does not melt or cake, is of great value in Sherardizing, as it eliminates the danger of spoilt work from carelessness in handling the temperature. Furthermore, zinc-dust containing as little as 35 per cent of pure metal can be used. The presence of the oxide is probably necessary, as it seems to play a part in the process.

Some Anomalies of the Process.

But why is it that zinc-dust acts in this peculiar manner, depositing zinc at a temperature several hundred degrees below its melting point, and why is it that the comparatively cold zinc alloys itself to the iron or other metal when the molten zinc of the hot process fails to do so, or at best only does so in a cumbrous limited way? I can only answer these questions by giving you my own theory of the nature of zinc dust and of its action under the conditions of Sherardizing. This theory is quite new to the very best of my knowledge and was not published by me until quite recently;* it

EXHIBIT—WESTERN FOUNDRY SUPPLY CO.

Electro Chemical and Metallurgical Industry, May, 1907.



EXHIBIT—DAYTON PNEUMATIC TOOL CO.

is founded on observed facts but is not entirely empirical, because so far it has seemed to satisfy all the theoretical tests to which I have been able to put it and it answers a number of unexplained phenomena which I shall mention later.

The Nature of Zinc-Dust.

The vapor of zinc which is given off at a temperature of 1,000 degrees Cent., or more, at the inception of distillation, comes into contact with the comparatively cold atmosphere of the flue, the sudden chill causes a rapid condensation of the vapor, so rapid indeed that it skips the liquid stage and drops in the shape of perfectly spherical particles of which about 30,000 million can be crowded into a cube measuring one-sixteenth of an inch in every direction. This impalpable powder which, notwithstanding its high specific gravity—for it is only about 10 per cent lighter than zinc—can be blown about like

lycopodium, is used mostly by paint manufacturers and is sold packed in barrels holding about 1,500 pounds. It is 10 or 15 per cent cheaper than virgin spelter at equal content of free zinc. It cannot be melted into slabs on account of its rapid oxidation at a very low temperature.

The peculiar properties of zinc-dust have been ascribed by some to the presence of cadmium, which being a more volatile metal is distilled first from the ore and condensed in the flues; one observer found quantities ranging from 0.283 to 0.794 per cent in flue dust after two hours of furnace operation. Others have claimed that these properties are due to the presence of zinc oxide or other impurities. No plausible reasons for these theories have as yet been advanced.

Most of the zinc-dust is produced in Belgium or in Silesia, and a sample which I have had analyzed showed the following composition:

Metallic zinc	88.95
Zinc oxide	6.88
Lead	3.45
Cadmium	0.62
Sulphur	0.55
Iron	0.04

G. Williams, an English chemist,* has shown that zinc-dust takes up water and decomposes it and gives up its hydrogen on heating; he has also shown that it absorbs hydrogen at ordinary temperatures when surrounded by it in a moist condition, and that heated alone it yields 50 times its volume of hydrogen, but when heated to redness with an equal weight of zinc hydroxide it gives off 535 times its volume of hydrogen. All this may have some bearing on the antics of zinc-dust and on Sherardizing, but as I am about to show it is unlikely and lacks confirmation, both theoretical and practical.

It is my belief that these impurities have little or nothing to do with the properties of zinc-dust and that the reasons should be sought for in its mode of production.

If under similar conditions of rapid cooling we produce other solid bodies we get unstable and brittle results. If a bead of fused glass is dropped into water a "Ruperts' tear" is the result. As you know, a Ruperts' tear is very unstable and whereas for a drop of normal glass of similar dimensions several good strokes of the hammer would be required to pulverize it, the Ruperts' drop can be shivered to fragments by breaking off its tail with two fingers, or by scratching the surface film where tension keeps the drop together. The difference of energy required to effect the destruction of the normal drop and the Ruperts' drop is enormous.

If we assume that zinc-dust is in this critical state we can explain almost every one of the effects which have puzzled chemists during the past forty years. Douglas Carnegie* found that zinc-dust *instantly* reduced ferric to ferrous salt, *and this even in neutral solutions* (the italics are his); this action he states was considerably quicker than with granulated zinc in the presence of sulphuric acid. He was at first inclined to ascribe this wonderful efficiency to the occluded hydrogen mentioned by Williams, but further experiments, which I need not detail, showed that he was mistaken. Referring to another chemical operation in which zinc-dust acted with equal promptness, he writes: "Zinc-dust merely effects instaneously the dechlorination which I found zinc foil required several hours to effect."

It is so well known that zinc-dust has a great affinity for oxygen at a low temperature that it has been used for a long time in the discharge style of printing of cotton goods. The fabric is first dyed a plain color and it is then printed on with a discharge paste. The zinc dust acts as a reducing agent at the temperature of the boiling water in which the cloth is dipped to effect the discharge.

A fact that is undoubtedly responsible in a great measure for the mystery attaching to the action of zinc-

* *Chemical News*, Vol. 52.

* *Trans. Chem. Soc.*, London, yr. 1888, p. 468.

dust is its readiness to oxidize. It is only when oxidation is put out of its power, as in the closed Sherardizing drum, that heat will produce sufficient overstrain to cause the particles to burst into vapor. This vapor so suddenly released will condense instantly on the coolest spaces it can find. In Sherardizing the coolest spaces are on the articles in the drum, and the drum itself being always hotter does not receive any deposit. One drum has already lasted two years without being coated. Zinc-dust appears to break down into vapor at about 150 to 200 degrees Cent., although it undoubtedly begins to disintegrate at a lower heat; as the pressure increases it takes a greater amount of heat to cause the breakdown; as the vapor condenses the pressure is relieved and the hotter particles of dust are vaporized and re-establish an equilibrium. In reference to this question of the vaporization of zinc, it is a well-known fact that zinc will at ordinary temperatures affect a photographic plate. This has always been ascribed to zinc vapor which exhibits in that state great chemical activity. Radiology, the new science, is expected to bear the burden of all such actions and I suppose I ought to say that the action of zinc on photographic plates is due to the slow disintegration of its atoms into energy and helium.

In a small way it is a significant fact that zinc-dust is intensely exothermic in its reactions, which means that these reactions are accompanied by the production of heat. I could also mention the property first pointed out by Schwarz, which zinc-dust has of combining violently with sulphur by percussion.

It has been known for some time that a cement made out of certain oils and zinc-dust possesses the useful property of becoming exceedingly firm and adhering closely to iron, steel and other metals, when heated to a temperature of 150 degrees Cent., or even less, if treated for a sufficient length of time. The theory of the nature of zinc-dust which I have given explains this hardening by the release of the zinc from its peculiar condition to form a solid without the formality of passing through the liquid stage. In the body of the cement it is protected from oxidation and the zinc becomes mechanically continuous. It is an excellent composition for calking cracks and crevices in metallic objects, for packing joints and for smoothing off the surface of castings.

I think that I have given you a sufficient number of examples to show that zinc-dust is a substance in a very abnormal physical condition and if I have spent so much time in doing so, it is because I feel certain that by taking advantage of this abnormal condition the metallurgical industries will before long reap important benefits.

(To be continued.)

PERSONAL.

E. J. Sherwin, formerly superintendent of the Akron, O., foundry of the Wellman-Seaver-Morgan Engineering Co., has resigned. Mr. Sherwin has had a wide experience in the foundry business, having at various times been superintendent of the foundries of the Falls Rivet & Machine Co., Cuyahoga Falls, O.; Brown & Sharpe Mfg. Co., Providence, R. I., and also erected a plant at Muskegon, Mich. He is familiar with all kinds of gray iron work, as well as the manufacture of semisteel. His present address is Cuyahoga Falls, O.

S. S. Knight, who for the past two years has been superintendent of Abendroth Bros.' manufacturing plant at Port Chester, N. Y., has been appointed general manager of the Huntington plant of the Globe Foundry Co., Huntington, W. Va.

D. J. Carson, who has been affiliated with the American Brake Shoe & Foundry Co. for the past two years, in charge of its New York office, has been appointed manager of the American Malleables Co.

FOUNDRY AND PATTERN SHOP APPLIANCES AND SUPPLIES

Mumford Loose Ring Riddle—Skin Drying Stove—Cleveland Sprue Cutter—Malleable Furnace—Franklin Air Compressor—Herman Molding Machine—Killing Molding Machines

IN all horizontally operated sand riddles, whether driven by hand or power, especially when the sand is tamped as in ordinary foundry practice, the sand which lies next to the screen itself moves little, if at all, to and fro on the screen. The sand next above it slides somewhat upon this nearly stationary sand until the top layers of all move nearly the whole stroke of the riddle with reference to the riddle itself. Thus it happens that a large percentage of the work expended in riddling sand in the old way is consumed in simply moving the sand upon itself, which produces no riddling effect. It is an old trick to carry sand in the riddle so that, sliding back and forth next to the wire, it will scrub the screen clean.

While operating a power driven riddle in connection with some work on the Rathbone multiple machine recently, plenty of scrap was used, but in spite of this fact, as about 50 molds an hour were being handled, the bottom screen filled very rapidly with clay from the sand, which was a little heavy, and the riddle clogged rapidly. The shaker in use was of the double screen type, the upper screen ¾-inch mesh, two inches above the lower screen, which was No. 4, and about No. 14 wire. With the idea of cleaning this bottom screen with the scrapers driven by the inertia of the sand itself, No. 20 gage galvanized steel sheets were cut into two-inch strips and bent by hand into rings approximately 5 inches in diameter.

Surprising results were obtained, for not only were the patches of clay at once swept off the lower screen, but inasmuch as the inertia of the body of sand, or what is the same thing, the entire work of the power shaker was devoted to moving all of the sand in the riddle at a uniform speed to and fro over the lower screen, it became immediately apparent that the efficiency of power shakers for sand was capable of large increase. The galvanized rings, however, did not last long and egg crate structures of sheet metal were tried and proved less satisfactory than the loose ring.

A careful working test has just been made under the direction of the E. H. Mumford Co., Philadelphia, which is manufacturing the riddle illustrated herewith. The test was made under practical foundry conditions of a power shaker fitted with loose rings and double screen, and was as follows: A single No. 4 screen, 20 inches by 30 inches, handled 195 shovels in nine minutes, and a double screen having the same dimensions, the upper screen consisting of ¾-inch mesh, No. 10 wire, and the lower screen No. 4 mesh, No. 14 wire, handled 150 shovels in 5½ minutes. The double screen with the rings added, however, riddled 281 shovels in 8½ minutes. The sand for all tests had been run through with the rings to get the scrap out, in order that what went through afterward might be of uniform quality, so that all the sand used was first passed through the No. 4 screen and was in that condition. Care was taken to make the shovelfuls as uniform as possible and the conditions of shoveling, working pressure, etc., were uniform throughout the tests. It was found that the gain in efficiency pro-

duced by the loose rings over the double screen was 21.4 per cent. The gain in efficiency of the double screen over the single screen was 25.8 per cent, while the gain in efficiency of the double screen with the loose rings over the single screen was 52.8 per cent. Another way of showing the gain in efficiency follows:

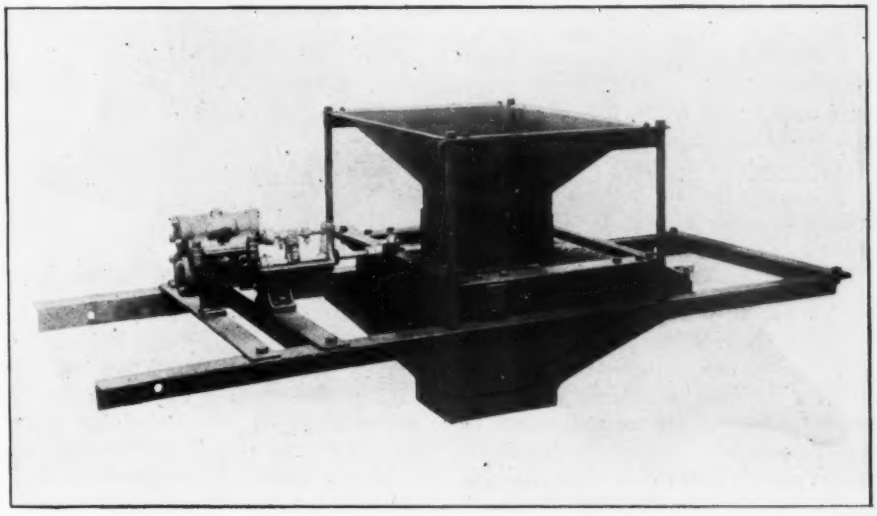
Total Shovelfuls	Riddle	Time	Shovelfuls per minute	Efficiency
195	Single No. 4	9 Minutes	21.67	1.00
150	Double	5½ "	27.3	1.258
281	Double with Rings	8½ "	33.1	1.528

or, the rings add again as much as the double screen.

The illustration represents the receiving and discharging hoppers with a power shaker between them, such as would be attached to the overhead structure of a sand conveying apparatus, the loose rings being adjusted under the coarse screen seen under the upper hopper.

SKIN DRYING STOVE FOR BRASS FOUNDRIES.

After long experience in the building of many drying stoves for the purpose of skin drying sand molds, a very efficient portable drying stove has been designed and is being sold exclusively by the J. W. Paxson Co., Philadelphia. The four sides of the stove as shown herewith are interchangeable, and are made of gray iron mixture that will stand an excessive heat. The sides are ⅝ inch in thickness, so that when heated they will do the most effective work and will retain their heat for a considerable period. The grate area is as large as the inner dimensions of the drier, thus permitting an increase in the supply of oxygen to support the combustion of coal and coke without giving off offensive gases and smoke. The grate bars are of square wrought iron, each pair being independent of the other; and rest in pockets on the inside. They can readily be replaced. The bars of the stove fit in dovetailed pockets and are thus made that they will always remain tight and will not drop out of place. They are located at the proper distance above the grate line, thus permitting the mold to receive the full benefit of the heat and to dry in the quickest time possible four molds at one time. The top of the drier has an opening for supplying the fuel, with a cover containing a wrought iron loop, that it may be easily removed when hot, by a rod or hook. An opening is pro-



THE MUMFORD LOOSE RING RIDDLE

vided in the top plate, with a collar to connect with a standard 5-inch stove pipe.

CLEVELAND SPRUE CUTTER.

The machine illustrated herewith has been designed for the heaviest

SKIN DRYING STOVES FOR BRASS FOUNDRIES

class of work and has a throat 15 inches deep. As the cutter is operated by a foot treadle and stops automatically at the highest point of the stroke, the operator has both hands free to guide the casting. The total height of the cutter is 6 feet 4 inches, and the throat height between knives 7 inches. The fly wheel is 30 inches in diameter, and has a 6-inch face and weighs 500 pounds. The total weight of the machine is 2,400 pounds. The capacity of the machine for yellow brass is 1½ by 1 inch, and for round brass gates, 1¼ inches.

A NEW MALLEABLE FURNACE.

The Buffalo Furnace Works, Buffalo, N. Y., has designed a malleable furnace, shown in Figs. 1 and 2, which embodies the best features of modern practice. The design throughout is along mechanical lines, strong, simple, and is constructed for hard and severe usage. In this construction there has been no attempt at beauty. The camel-back roof which predominates in malleable furnace construction throughout this country has been replaced with one having a lower arch, as it has been found from experience that more economical results are obtained in fuel consumed with this type, as the heat is held down directly on the bath of metal instead of dissipating itself on the furnace roof. By proper proportion of

CLEVELAND SPRUE CUTTER

the various sections of the melting chamber the heat pressure is kept uniform throughout the length of the furnace, which has proven very desirable in rapid and hot melting.

The charging and skimming doors shown in Fig. 4 are brick lined and are of the swinging type. The fire

door, shown in Fig. 5, has met with approval, as through its long and narrow mouth the coal can be easily distributed to all parts of the grate. The closing and clamping device is efficient and simple. The roof bungs are of rod construction, and the life of the brick is much prolonged, due to the even distribution of clamping pressure to the entire surface of each brick.

The lower or foundation tie rods are protected from slow burning or rusting away and will not permit of the spreading or bursting of the furnace sides. Heavy cast iron plates or aprons with air spaces are placed under the skimming doors to prevent hot slag from cracking the furnace walls. From 3¼ to 3½ pounds of iron can be melted in this type of furnace per pound of coal, which is claimed to be from 25 to 50 per cent higher than general practice.

These furnaces are built in capacities ranging from 4 to 40 tons.

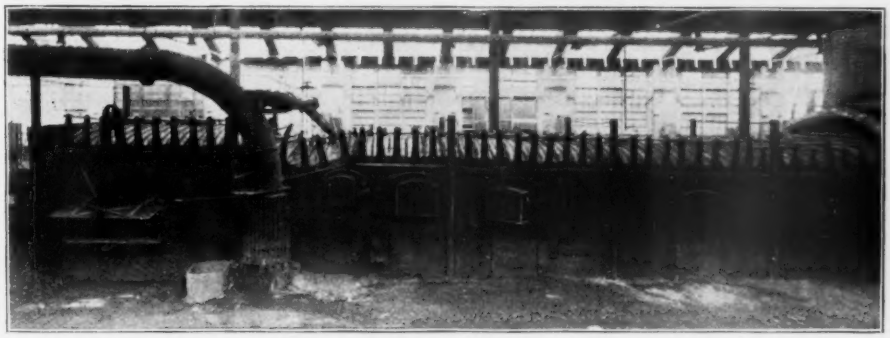


FIG. 1—MALLEABLE FURNACE

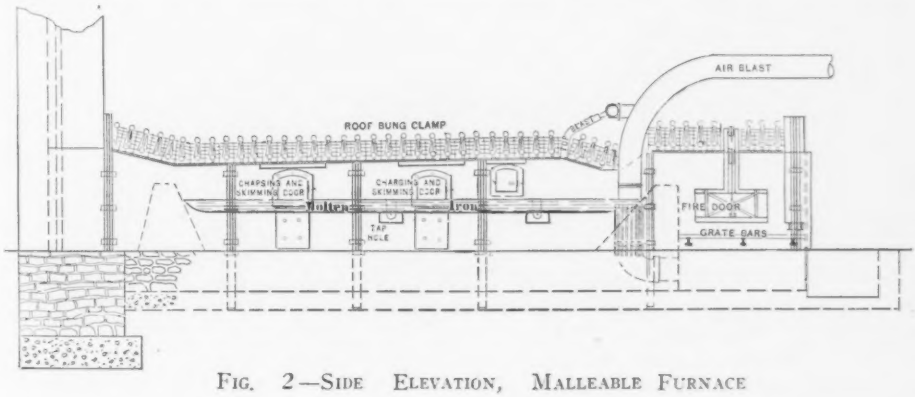


FIG. 2—SIDE ELEVATION, MALLEABLE FURNACE

THE NEW FRANKLIN AIR COMPRESSOR.

The Chicago Pneumatic Tool Co., Chicago, being manufacturers of machines using compressed air as a motive power, its attention was naturally directed to the most efficient means of producing compressed air, these investigations eventually leading to their entry into the field of compressor manufacture, enabling the company to offer complete equipment of its own make, supported by one guarantee and eliminating the division of responsibility.

The compressor shown herewith is especially suited to the requirements of industrial works, mines, quarries, etc. It is of duplex pattern, with simple or cross compound steam cylinders and simple or two-stage air

compressing cylinders, according to working conditions. A variety of combinations is obtainable for varying pressure conditions, and machines are also built for motor or water wheel drive, either direct or by belt, gear or chain. These compressors are built in sizes ranging in capacity from 30 to 2,000 cubic feet of free air per minute displacement for 10 to 125 pounds per square inch working air pressure, and suited to all compressed air uses. Frames are heavy box-shaped castings, graceful in outline, strongly ribbed with large factor of safety to withstand strains when working at maximum load. The bottom surface bearing upon foundation throughout its entire length insures stiffness, not only at the main bearing, but also along the guides and at the connection with the cylinder. This construction affords an even distribution of strain upon the foundation and also of the internal stresses which the bed itself must sustain. Cross head guides are bored and provision is made for catching and draining drip from bearings and stuffing boxes. Being entirely self contained, expensive foundations are avoided and expert erection services unnecessary.

Steam cylinders have exterior walls covered with asbestos or mineral wool, and are neatly lagged with planished iron. Air cylinders and cylinder heads are completely water jacketed, providing a thorough circulation of water with equal cooling at all points. Pistons are of solid type with cast iron spring rings accurately fitted. The shaft is of center crank type of ample diameter, made of the best open-hearth steel, with exceptionally heavy crank arms.

The box crosshead is provided with taper shoes, turned to fit the cylinder guide. These shoes have screw adjustment affording a ready means of taking up the slight wear and of securing proper alignment. Oil guards at each end of the lower slide on the bed give continuous lubrication to the lower shoe, while a sight feed oil cup on top of bed provides the necessary oil for the upper shoe. The piston rod is screwed into crosshead and secured by a lock-nut. The connecting rod is of substantial pattern, with solid crosshead end having wedge and adjusting screws. Crank end is of marine type, with heavy bolts and brass liners. Both ends are simple in construction and well adapted to the required services. The single compressor has two balance wheels, one on each side, to insure smooth operation. Duplex and cross compound compressors have heavy flywheels made in two sections, securely bolted together

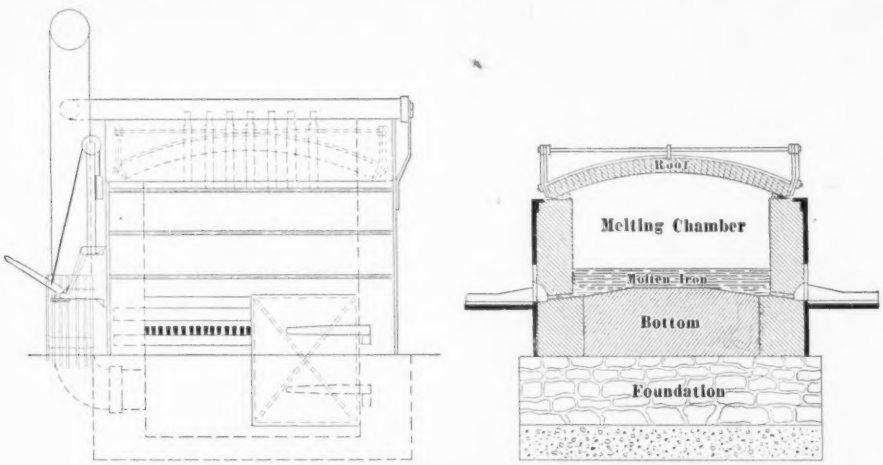


FIG. 3—END ELEVATION AND CROSS SECTION MALLEABLE FURNACE

at the hub and at the rim. All bearings are of unusual liberal proportions, and only the best materials are used in their construction, with the most approved provisions for adjustment, designed to eliminate all trouble from heating and to reduce wear in working parts to a minimum.

Steam driven compressors are provided with a pressure regulating governor to automatically control the operation of the compressor in accordance with the demand for air, working in connection with a speed governor, which regulates the speed of the compressor. Single steam and belt-driven compressors also have an unloading device to relieve the compressor of all load when the desired air pressure is obtained, and automatically cause it to resume delivery when the receiver pressure becomes reduced. Smaller steam driven compressors have plain "D" slide valves accurately scraped to seat and securely fastened to rod with adjustment for wear. Steam cylinders, 12 inches diameter or larger, are provided with Meyer adjustable cut-off valves, the main valve being balanced, thus reducing the liability of excessive wear and increasing the life of the valve and valve gear by relieving the strain upon all valve gear parts.

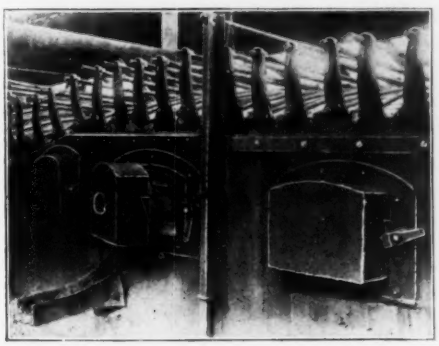


FIG. 4—CHARGING AND SKIMMING DOORS

Balance plate and steam chest cover are both designed to provide the necessary rigidity to prevent their deflecting under the steam pressure. Any deflection impairs the contact between balance ring and its sliding surface on the cover, and will cause leakage. Balancing area is ample, but not so great as to over-balance at any point of valve travel. The requisite area has been theoretically determined and proven by experience. A graduated scale indicates the point of cut-off which may be adjusted from one-

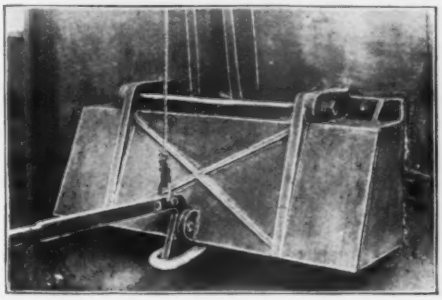


FIG. 5—FIRING DOOR

fourth to seven-eighths of the stroke while compressor is running. All valve rods, eccentric rods and links are made of steel, with steel heads bushed with bronze and provided with take-up. Gear is nicely finished and polished throughout.

Air inlet valves of poppet type are made from high grade steel having removable seats and guides, easily renewed or repaired and thoroughly guarded from entering cylinder in case of breakage. They are placed radially in cylinder, rendering them readily accessible, insuring accurate seating, and reducing wear to a minimum.

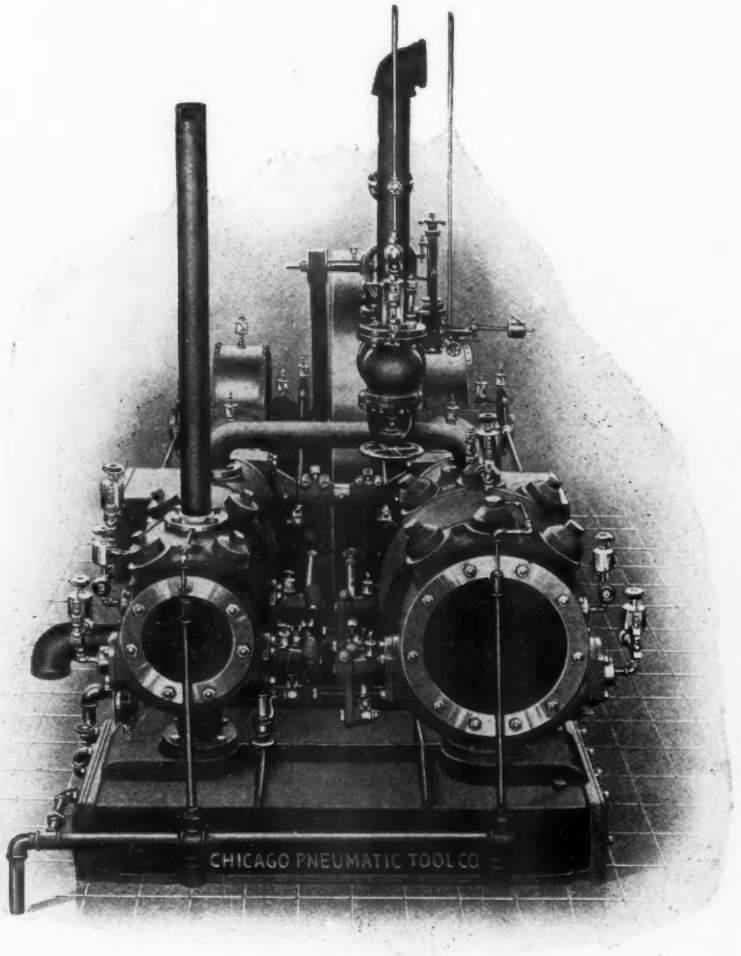
Too much importance cannot be attached to the feature of accessibility, for the valves sustain the severest service of air compression and the heat incident thereto. Should the valves cease to perform their proper functions, the compressor is either wholly or partially disabled until the trouble is remedied; hence the great desirability of immediately accessible valves.

The valve stem and head are forged in one piece, entirely avoiding the use of flange nuts, jam nuts, split pins, or other contrivances intended to serve as a head for the stem, requiring constant supervision with continual liability to work loose. The valve seat is a part entirely separate from

the cylinder proper and may be removed, replaced or renewed whenever occasion requires. The valves and seats are placed in position after the heads are attached to the cylinder, and are held securely by large screw plugs. As the heads need not be removed, it is but a moment's work to take out the valve.

The valve springs are of steel, light enough to minimize resistance in opening, yet strong enough to promptly seat the valve in closing. The proportion of valve area is exceptionally liberal, enabling the cylinder to fill freely at each stroke without volumetric loss or impaired efficiency due to the wire-drawing effect of insufficient valve area.

To meet the objections sometimes offered against a numerous complement of poppet valves, compressors of larger size are also built with mechanically moved intake valves of semi-rotary Corliss type, placed in the cylinder heads and driven by gear from eccentrics on the main shaft. These positively moved valves combine exceptional area with short ports and minimum clearances. They open and close without impact and are therefore free from the hammering and wear incident to poppet valves. These valves are driven by separate eccen-



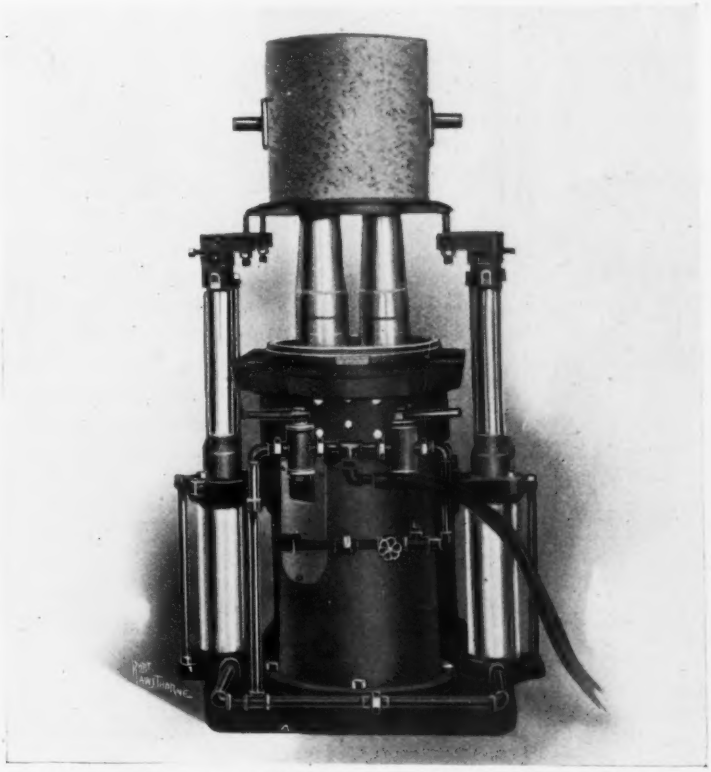
FRANKLIN AIR COMPRESSOR

trics, which on duplex steam driven machines have the advantage of allowing adjustment of air valve gear without disturbing the setting of the steam valves.

The valve gear details are of generous proportion and the pins and bearings of ample size. All bearings throughout the gear are provided with phosphor bronze bushings adjustable for wear. Inlet as well as discharge valves can be removed and inspected without disturbing the valve gear.

All air discharge valves are of poppet type, cup shaped, pressed from high grade steel and fitted with light tension springs. These valves have removable seats and guides and are readily accessible for adjustment or repair.

The intercooler provided with two-stage compressors forms part of the compressor base, being located directly under the air cylinders, minimizing piping and floor space and rendering the compressor with its intercooler completely self-contaned. The intercooler tubes are of brass or charcoal iron expanded into steel tube sheets. Ribs are provided in water heads and baffle plates inserted between tubes, ensuring complete circulation of both water and air.

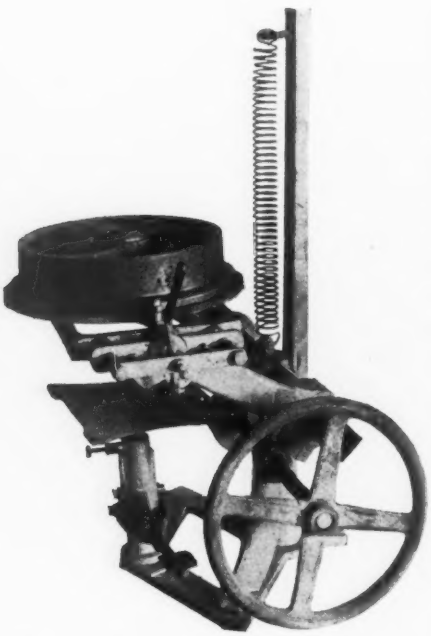


HERMAN PNEUMATIC MACHINE FOR MOLDING SKEIN BOXES

HERMAN MOLDING MACHINE.

The Herman Pneumatic Machine Co., Zelienople, Pa., has recently placed on the market the machine shown in the accompanying illustration, which is being used for molding skein boxes. The table plate of this machine is 16 inches by 19 inches and is well adapted to take flasks of the same lineal dimensions. There are four skein box patterns in one flask and in this case stripping plates were used, although it can be readily understood that the most of the work

can be rammed on this machine without any supplementary aid. The two side lifting cylinders shown have a two-fold action, one of which is to lift the mold away from the pattern, and the other is to lift the mold and pattern together, which can then be rolled over in the trunnions that are



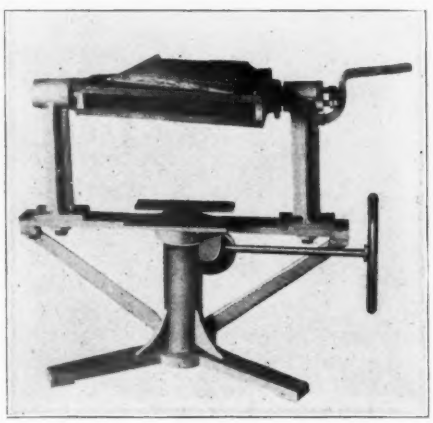
KILLING ROLLOVER MOLDING MACHINE.

on the heads of the lifting pistons and the pattern drawn upward from the mold as in the ordinary method of hand ramming.

ROLLOVER MOLDING MACHINES.

Two different types of rollover molding machines, one of which drops the flask away from the mold, and the other raises the pattern out of the flask with a perfectly straight draw, are now being offered the foundry trade by the Killing Molding Machine Co., Davenport, Ia. Both the cope and drag can be molded on one machine, and as the pattern plate revolves around its own center, the operator of the machine always remains in the same position. The rollover machine illustrated herewith can be styled a universal machine, as it is so constructed that any size flask, up to 36 x 24 inches, with a 12-inch draw, can be successfully handled on one machine.

The bars which support the pattern plate are adjustable for width and the small table which is operated by a ratchet takes care of adjusting itself for the different heights of flasks. The machine shown has a plow point mounted to its frame. The other machine, which raises the pattern out of the sand, is called a straight draw rollover machine. Balanced by a spring, it requires little power to raise the pattern out of the mold, which is done by means of a large hand wheel that gives the operator a great leverage. In operation the pattern is placed on the frame of the machine or a wooden follow board can be used. The flask is then rammed and released by a small lever and the mold is rolled over. The table is raised



KILLING ROLLOVER STRAIGHT DRAW MOLDING MACHINE

against the bottom board by a small foot lever, and the clamps are then released. The hand wheel is then turned to the right and the pattern is drawn out of the mold. The cope can likewise be rammed up on the same machine.

ANNUAL MEETING ASSOCIATED FOUNDRY FOREMEN

Membership Shows a Rapid Growth—Local Organizations Are Prospering

THE fifth annual meeting of the Associated Foundry Foremen was held in the Manufacturers' Club on Monday evening, May 20. The attendance was large and the enthusiasm manifested was indicative of the interest that is being shown by the foremen and superintendents in this organization. The meeting was called to order by President W. H. McPhee, and after a few preliminary remarks as to the object of the association, an opportunity was given those who wished to join to make application for membership. After reading the minutes of the previous meeting, reports were presented from the following locals: Erie, Chicago, New York, Cleveland, Philadelphia, Hamilton, Ont., and Indianapolis. Considerable progress was reported by all these associations, but Milwaukee, Cincinnati and Montreal not being represented, no report was received. The annual report of the secretary, F. C. Everitt, showed an increase in membership of 36, making a total of 370. Despite these forward strides, the secretary said he regretted that insufficient interest is taken in this association by the foundrymen and their foremen.

The secretary's report follows:

In presenting a brief report of the activities of the association for the fiscal year now about to close, we will note with much interest that our affairs are in a satisfactory condition and that the value of our organization is steadily increasing.

The association has materially increased in membership and to such an extent that we are able to report a total of 370 at the present time which is a net increase of 36 over the number reported a year ago.

The response of our members, in an effort to place themselves in better standing with the association, has been much greater up to the present time than has been the case for some years past. It is not to be inferred, however, nor must we be content to think that the above conditions are what we most desire.

Whether these encouraging conditions are the results brought about by the advent of the Foundry Supply Association, in which case the foremen and their employers have recognized the opportunity of accumulating valuable knowledge concerning the line of more modern foundry appliances which incidentally would be a source of much profit to them, or the recognition of the fact that the results of the work of these organizations are beginning to impress more thoroughly the subjects of advanced foundry practice in a light that appears at this time more profitable than ever, is a question that remains entirely with our judgment.

However, the value of the latter combined with the many valuable advantages presented by the former, we must all admit, provides a most economical course for education in the many branches of foundry science.

It is much to be regretted that more of the foundrymen and their foremen do not readily enter into this work and place their years of experience in the field that the know

ledge in general on the foundry practice of this country might be broadened to a greater extent, and our foreman provided with a more complete course for study with the paramount idea of educating himself, not only from a practical standpoint, but this combined with enough of theory that he may more intelligently discuss and manage general shop affairs.

I do not here wish to be misunderstood in regard to the progress already made, for we all appreciate that during the eleven years since this work was begun by the American Foundrymen's Association this progress has been quite phenomenal and most thorough.

bly not with this generation, but surely with the ones to come, be so adjusted as to provide a course of education that will be well within the means of any apprentice who is to be educated as the future foundry foremen and operator.

This is not a new adventure at the present time, for we have within our own association a member who is now conducting in the south an industrial school for the education of foundry apprentices. This particular case has come to our notice only within the last few months and it is to be hoped that we may learn more of this enterprise during the coming year, and if properly directed

JAMES F. WEBB

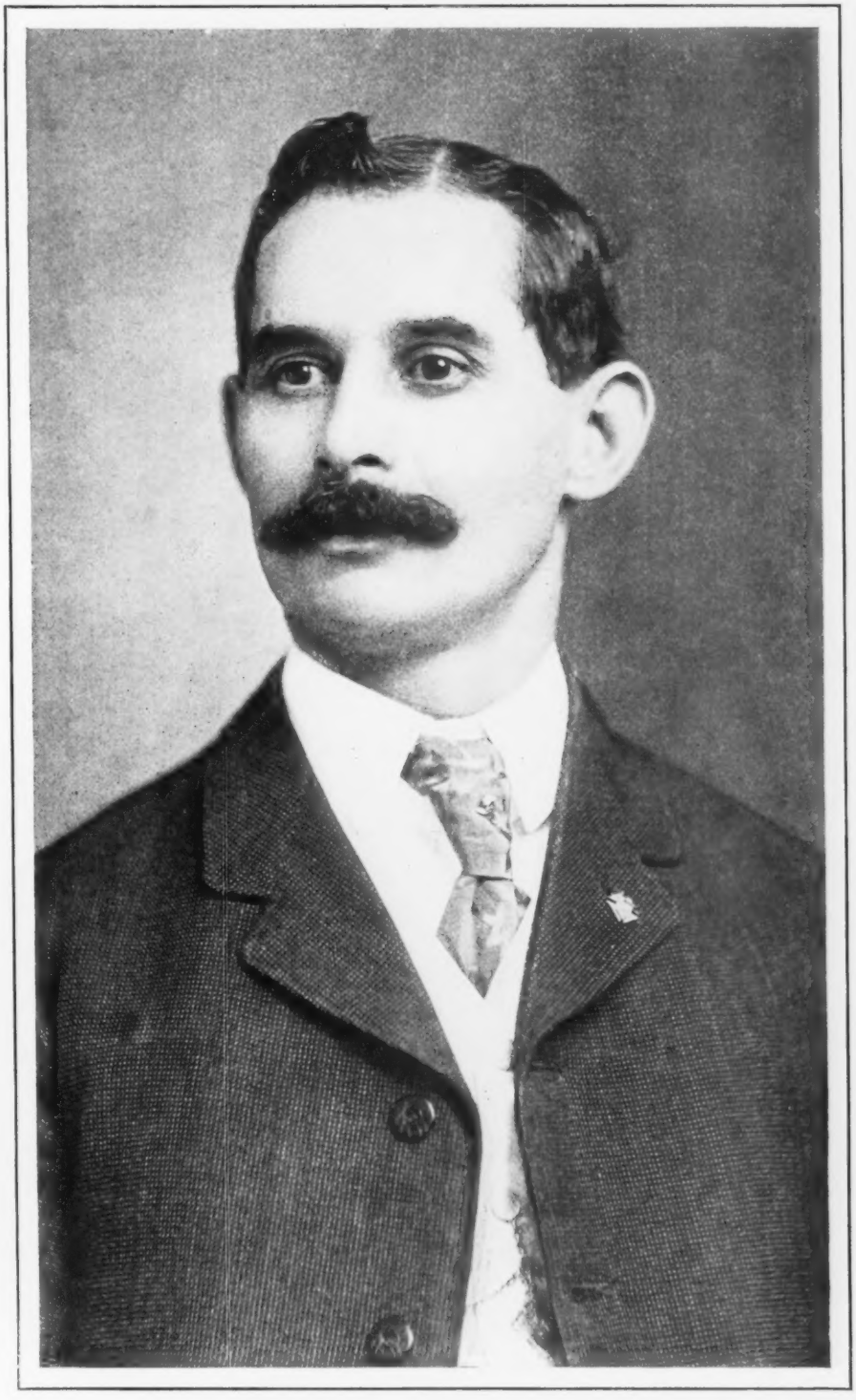
JAMES F. WEBB, who was elected president of the Associated Foundry Foremen at the recent annual meeting in Philadelphia, has had a wide experience in foundry work, covering a period of more than 20 years. He was born in the city of Cleveland, September 4, 1870, and left school at the age of 14, to become an apprentice in the Maher & Brayton foundry. He remained in this shop for a period of 12 years and after securing considerable experience in other foundries in the Forest city, left for the east in 1890, where he accepted a position with the Sessions Foundry Co., Bristol, Conn. Upon leaving this concern he was employed at various times with a large number of shops in the east and in 1899 engaged with the General Electric Co., Schenectady, N. Y., where he remained until 1903. In that year he left this concern to accept the position of assistant foreman in the locomotive cylinder department of the Schenectady plant of the American Locomotive Co. The following year he returned to Cleveland where he accepted a position in the foundry of the New York Central lines at Collinwood, O., and was latter transfered to the company's shops at Elkhart, Ind., where he is at present employed in the capacity of assistant foreman.

The amount of appreciation shown by the foundrymen and their foremen throughout the country, excepting, of course, those directly interested in these associations, for the enormous amount of tedious and careful investigating, to say nothing of the voluminous and far extending correspondence that has been necessary to bring about the present state of perfection of conditions in foundry practice is far below what might be expected in a country where so many economical educational advantages are accessible.

As has been the case in many lines of the engineering world, the results from these years of labor and investigation may in the near future, possi-

the desired foundry foremen will be the result.

Our association is yet in its infancy and to bring it to the state of perfection that is much desired by those who are most interested and appreciate fully the value and scope of the work that will be necessary, it will be a matter of the greatest importance for the affairs of the association to be conducted by those of our members who will be most considerate and diplomatic in their judgment, untiring in their efforts, most thorough in the execution of such investigations as may be placed in their care for disposal and display the most willing and patient disposi-



JAMES F. WEBB
President of the Associated Foundry Foremen

tion with an unlimited amount of courage which will overrule the many discouraging features that will constantly be encountered.

The object of our endeavors is the sole purpose of increasing our knowledge on general foundry practice, and with the hearty co-operation and consideration of our members, the efforts of our officers will in due time place our association, we hope, far beyond the desired state of perfection.

The individual cost of this co-operation and support is exceedingly small, but sufficient to carry our affairs in a satisfactory condition and provide additional amounts for experimenting and assisting the mother organization by carrying our share of the burden.

We sincerely trust that the increasing interest of our members will continue. The result can be no other than beneficial to us all.

The valuable support and assistance that we have received and which is always at our command through our good friend, Dr. Moldenke, is certainly greatly appreciated and we extend to him our hearty thanks.

The receipts and expenses for the year are as follows:

Cash on hand June 4, 1906	$106.80
Total receipts to May 20, 1907	304.27
Total expenditures	248.31
Balance May 20, 1907	$162.76

REPORT OF MEMBERSHIP.

Honorary members June 4, 1906	21
Active members June 4, 1906	313
Total	334
Honorary members May 20, 1907	23
Active members May 20, 1907	347
Died	1
Resigned	1
Dropped	2
Total membership	370
New members received	40
Net increase	36

Election of Officers.

After the report of the auditing committee, which showed the records and accounts to be in a very satisfactory condition, the nominating committee made its report and the following officers were elected: President, Jas. F. Webb, L. S. & M. S. Ry., Elkhart, Ind.; first vice president, W. S. McQuillin, Allegheny Foundry Co., Warren, Pa.; second vice president, W. O. Steele, Bateman Mfg. Co., Grenloch, N. J.; secretary and treasurer, F. C. Everitt, J. L. Mott Co., Trenton, N. J. Under the constitution of the Associated Foundry Foremen the presidents of the local associations become vice presidents of the national organization. They are as follows: W. F. Grunau, Erie, Pa.; Thomas Glasscock, Milwaukee, Wis.; E. W. Smith, Chicago; Hugh McPhee, New York; W. A. Keller, Indianapolis; Hugh Mackenzie, Cleveland; W. A. Perrine, Philadelphia; David Reid, Hamilton, Ont., H. J. Holmes, Cincinnati.

Revision of Constitution and By-Laws.

Retiring President Hugh McPhee was elected to honorary membership. The method of electing officers aroused considerable discussion and it was the sense of the meeting that the opportunity be afforded each of the delegates to cast a ballot for any of the various aspirants, instead of having that power delegated to the secretary. A committee of five was appointed to revise the constitution and by-laws and was instructed to report at the next meeting. It is made up as follows: A. M. Loudon, W. A. Perrine, A. T. William, M. C. O'Connor and F. C. Everitt. The officers elected were then called upon for remarks and all asked for the co-operation of the members, that they might more efficiently execute the duties of their offices and be able to present reports of progress at the next meeting.

Joe Dinkelspiel, of the Partamol Co., New York, in a few well chosen words, stated that he would put forth his best efforts to increase the membership of the association during the year and promised to contribute $100 if the membership reaches a total of 500 at the time of the next convention.

Special Meeting.

At a special meeting held at the Second Regiment Armory Wednesday evening, May 22, a plan for the circulation of papers read at the meetings of the various locals was discussed and adopted. The plan outlined in-

cludes the sending of all papers read at the local meetings to the secretary's office, where they will be compiled and printed in pamphlet form and later issued to all of the members of the association. Each local will receive copies which will serve to provide material for discussion at their meetings. Every effort will be made to make the plan effective and it is believed that the results will be beneficial.

A pleasant feature of the river trip to Washington park was the presentation of a diamond ring to F. C. Everitt, the efficient secretary of the Associated Foundry Foreman. The presentation speech was made by W. O. Steele, Grenloch, N. J.

TRADE NOTES.

The firm of Geo. F. Crivel & Co. is among the latest concerns to engage in the foundry supply trade, and has established a plant at 314 Michigan street, Buffalo, for the manufacture and sale of facings and other foundry supplies. Geo. F. Crivel, than whom there are few better known in the foundry supply business of this country, is the moving spirit of this concern. His experience covers a period of 22 years. He receved his early training with the S. Obermayer Co., Cincinnati, and remained with this firm for a period of 12 years, and for the 10 succeeding years was connected with F. B. Stevens, Detroit, having resigned last December. Mr. Crivel traveled over the Northwest as far as Minneapolis and Denver, also Indiana, Michigan and Ohio for a great many years, and during the last six years included New York state with his former territory. Before engaging in the foundry supply business Mr. Crivel worked in the foundry of Garr, Scott & Co., Richmond, Ind., where his father held the position of foreman for a period of 42 years, and is at present the only member of the old firm still alive.

The Sturtevant Engineering Co., of 147 Queen Victoria street, London, who are the European representatives of the B. F. Sturtevant Co., Boston, has just opened a new office at 2, Rue Lebeau, Brussels.

Statements regarding the successors of the firm of Crowell & Peck, chemists, have in some instances been misleading, and the following statement has been issued by Francis J. Peck & Co., Cleveland: "The old firm of Crowell & Peck was dissolved and Francis J. Peck, formerly with the company, purchased all of the property of the dissolved firm, including offices and laboratories, in the Williamson building, and the crushing and testing plant on River street, together with the leases, fixtures, appliances and appurtenances. Mr. Peck is now engaged under the firm name of Francis J. Peck & Co. in all the lines of business formerly conducted by Crowell & Peck, namely, as mining engineers, chemists, assayers, metallurgists and inspectors of iron, steel and cement."

The Northern Engineering Works, Detroit, is installing four 5-ton special electric Northern jib cranes in the new pipe foundry of the United States Cast Iron Pipe & Foundry Co., Burlington, N. J. Two of these are of the column jib type and two of the transfer jib type. These cranes will assist the overhead traveling cranes and they are all of high speed design, especially suited to pipe foundry service. This company also installed a 20-ton electric Northern traveling crane.

In order to handle more efficiently their rapidly increasing trade in New England, Dalton, Nash & Co., New York, dealers in pig iron and coke, have opened an office at 621 Board of Trade building, Boston, in charge of F. F. Newcomb, who has had a wide experience in the iron business, having for many years been associated with the Philadelphia office of Rogers, Brown & Co.

Construction work on the new plant of the Hill & Griffith Co., Cincinnati, is progressing rapidly. The mill building will be completed and

fully equipped about July 1. The office building was recently completed and is now occupied.

B. F. Sturtevant Co., Boston, include among their recent sales of high pressure rotary type blowers the following: Link-Belt Co., Chicago; Seybold Machine Co., Dayton, O.; Hammond Glue Co., Hammond, Ind.; Whitin Machine Works Whitinsville, Mass.; Phoenix Bridge & Iron Works, Montreal, P. Q.; Hawley Down Draft Furnace Co., Chicago, Ill.; McGill University, Montreal, P. Q.; Carr Engineering Co., Los Angeles; Whiting Foundry Equipment Co., Harvey, Ill.; James J. Anderson, Chicago; and Watson-Stillman Co., Aldene, Union county, N. J.

The Fox Machine Co., Grand Rapids, Mich., has received an order for two No. 8F Fox trimmers, which is the largest size trimmer manufactured by this company, and 20 of the small No. 4A Fox trimmers for installation in the Erie, Pa., plant of the General Electric Co.

Pawling & Harnischfeger, Milwaukee, manufacturers of traveling cranes, announce the removal of their Chicago sales office to 1241 Monadnock building, with W. E. Kreamer as district manager, having recently been transferred from the Denver office. He is succeeded in the west by H. N. Steinbarger. The former Chicago representatives, G. P. Nichols & Bro., will continue their business in the Old Colony building.

The Killing Molding Machine Co., Davenport, Ia., manufacturer of stripping plate, automatic roll-over, rock-over and roll-out machines, has increased its capital from $20,000 to $40,000. This increase was made necessary owing to the rapid growth of the company's business.

The Killing Molding Machine Co., Davenport, Ia., has installed 12 standard stripping plate molding machines in the new foundry of the Green Engineering Co., Chicago. This plant is 200 x 150 feet and contains two 10-ton Whiting cupolas.

The Piqua Blower Co., Piqua, O., has been compelled to add considerable machinery, owing to the heavy demands for its blowers. Among the machines it recently installed was a 60-inch by 12-inch, 2-pitch Eberhardt Bros. gear cutting machine. This company recently sold a positive pressure blower to Abendroth Bros., Port Chester, N. Y., and an 18 to 25-ton per hour sensitive blower, direct connected to a 55-horsepower motor to the National Car & Foundry Co. The Massillon Foundry & Machine Co., Massillon, O., also recently installed a blower of this type.

The New York office of the B. F. Sturtevant Co. has been removed from 131 Liberty street to the new Engineering Building at 114 Liberty street, where much better facilities will be provided for conducting the rapidly increasing business of this concern.

Ph. Bonvillain & E. Ronceray, Paris, France, manufacturers of the Universal system of molding machines, have established an office in Philadelphia at 1315 Race street, for the sale of their full line of molding machines and foundry appliances in the United States. A full line of machines will be carried in stock.

The Engineers' and Founders' Laboratories have been established at 439 Third avenue, Pittsburg, by Henry Gulick Jr. and J. W. Henderson. The former has had charge of the inspection of cars and car equipment in the Pittsburg district for the R. W. Hunt Co. during the past six years, while Mr. Henderson has been connected with the iron and steel business since 1887, beginning with laboratory work for the North Chicago Rolling Mill Co. During the past twenty years he has had exceptional experience in cast iron car wheel, gray iron and malleable work. He was formerly superintendent of the plant of the Central Car Wheel Co., McKees Rocks, Pa., and left this concern to build and operate the plant of the Butler Car Wheel Co., Butler, Pa., engaged in the manufacture of cast iron car wheels and gray iron castings. He severed his connection with this firm on June 1.

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Philadelphia Meeting of the A. F. A.

Aside from the interest manifested in the proceedings and the unparalleled display of foundry supplies and equipment, the success of the Philadelphia convention of the American Foundrymen's Association should be measured by the attendance, which established a new high record and reached a total of nearly 1,400. Never before in the history of the industry has there been such a gathering of foundrymen. Never before was there such a display of enthusiasm by men drawn together by ties of a common calling. Every city in the union contributed its quota of employers, superintendents, and foremen, and Canada was represented by a large delegation. This meeting in a measure reflected the tremendous forward strides of the foundry trade in recent years and foreshadowed advancement that will surpass all previous achievements. The papers presented covered every phase of the foundry industry and were prepared by specialists in their respective lines. The general hospitality of the Philadelphia foundrymen was shown by the lavish entertainment provided, which was on a scale more prodigious than hitherto attempted.

Exposition of Foundry Equipment

The exposition held under the auspices of the Foundry Supply Association was a pronounced success, and the great auditorium and adjoining spaces were crowded to accommodate the products of some 70 manufacturers of foundry supplies and equipment. One year ago at Cleveland about half that number availed themselves of the first opportunity offered to exhibit in connection with the foundrymen's convention. Returns, however, were found to be so satisfactory that plans were made for a more extensive show at the Philadelphia meeting. So great was the interest manifested in this display that the regular sessions of the convention were in a way overshadowed.

The exhibitors found that as a class visitors were intelligent, well-informed foundrymen, that they came with the idea of availing themselves to the utmost of the opportunities offered for the comparative study of the newest demonstrations, and that in many instances they were authorized and ready to make purchases. The convention hall was crowded throughout the week, demonstrators were kept busy and exhibitors went home with ample returns in the way of live, dependable inquiries, and in many instances with a surprising number of direct orders. In addition, the educational effect of the exposition was highly important. One exhibitor declared: "It has advanced the sale of my machines at least five years," and a canvass of all the exhibitors failed to disclose a single instance where returns were not thoroughly satisfactory.

American Brass Founders' Association

The organization of the American Brass Founders' Association is indicative of the rapid growth of this branch of the foundry industry and for the present, at least, all concerns whose product is manufactured from the non-ferrous metals are entitled to membership. The interest displayed at the sessions devoted to the formation of this body bespeaks a bright future for this association, and excellent results will undoubtedly be obtained as an outcome of organized effort. The brass industry today is confronted with problems similar to those which beset gray iron operations ten years ago, and which have largely been dissipated as the result of the excellent work accomplished by the American Foundrymen's Association.

Discussion of Technical Papers

The limited discussions which followed the reading of the papers is to be deplored, and at future meetings more time should be allotted the sessions of the American Foundrymen's Association. Sufficient opportunity should be afforded for the proper consideration of the ideas advanced by the various authors, as frequently the discussions prove more valuable than the papers themselves. The close proximity of the convention hall to the supply association exhibit was by no means advantageous, as the one interfered with the other and the convention suffered. To insure a close application to the reading of papers, the meeting room should be free from interruptions and some arrangement should be made whereby the assembly hall at future meetings will be located at some distance from the exhibits.

Trade Outlook

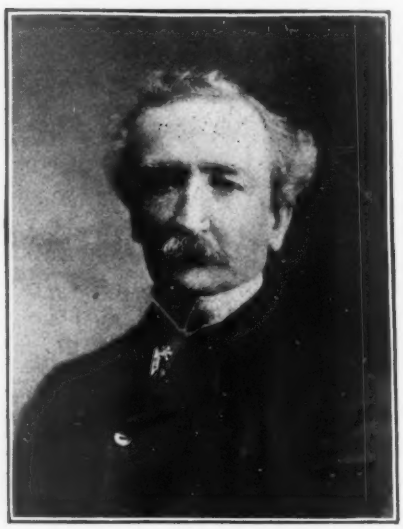
The pig iron markets throughout the country have settled down to a period of protracted dullness, and during the month of June there were no transactions of note. Lake Superior charcoal for prompt delivery at Chicago commands $27.50 to $28.00, and Northern coke No. 2, $26.50 to $27.00, with malleable Bessemer on practically the same basis. Bessemer and basic are quoted at $24.40 Pittsburg, while in the east the latter grade is slightly easier. In the Birmingham district southern iron is held at $22.50 to $23.00, with concessions of $2.00 a ton for the last quarter. This quiet market is without significance, however, as practically all consumers have covered their requirements to the end of the year, and are not interested in 1908 needs at the present time. In the foundry trade malleable and steel foundries are comfortably filled to the end of the year, although the gray iron jobbing plants are in the position to give better deliveries than at any time in the past six months.

ST. LOUIS LEADS IN STOVE FOUNDRIES.

The city of St. Louis claims a larger stove output than any other stove manufacturing center in the world. It is claimed on authority that 770,000 stoves, valued at $8,000,000, were manufactured in that city in 1906.

OBITUARY.

John A. Walker, vice president and treasurer of the Joseph Dixon Crucible Co., died at his home, Jersey City, N. J., on May 23. Mr. Walker was born in the city of New York, Sept. 22, 1837. He received his early education in the schools of Brooklyn, and, although prepared for college in a private school, chose commercial life. After an excellent business training in the city of New York, and after serving his country in the civil war, Mr. Walker in 1867 became connected with the firm of Joseph Dixon & Co., of Jersey City. In 1868, when the firm became incorporated as



JOHN A. WALKER

the Joseph Dixon Crucible Co., he was made secretary and began his life work in making known to the world the many uses of the then but little known form of carbon,—graphite. Mr. Walker served the Dixon Co. as secretary and largely as manager until 1891, when he was unanimously elected to the dual position of vice president and treasurer, the latter office having been held by him for some time previous. He held these offices without interruption until his death, the general management of the company also being largely in his hands. Untiring and persistent devotion to business, however, with increasing age and lack of needed rest and recreation, began to tell on his vigor and strength, and on April 24 he went home for what he and his intimates supposed would be a few days' rest. Complications set in and a month later he died.

Despite his heavy duties as vice president and treasurer of his company, Mr. Walker found time to devote his energies to outside interests and he was responsibly connected with life insurance companies, trust companies, charitable, social and business organizations. He had held public positions of trust in his home city. Whether as public official or officer of any institution, or member of any club, Mr. Walker was always prominent and was always successful.

Patrick J. Geraghty, secretary and treasurer of the Griffin Wheel Co., died April 30, after a brief illness, at his home in Chicago. He was widely known in the iron and steel trade, having been connected with the Griffin Wheel Co. since 1885.

Charles Haynes Haswell, the famous engineer, died May 12, from the effects of a fall, at his home in New York. He was known as the dean of the profession of civil engineering the world over, and though nearly 98 years of age, was in charge of important city construction work. He was engineer in chief of the United States navy for several years, and rendered valuable service in bringing the early steam navy to a state of higher efficiency. Since 1851 Mr. Haswell has been engaged in engineering practice in New York and designed and built many of the extensive public works of that city. He was the author of "Haswell's Mechanics' and Engineers' Pocket Book," which has passed through 71 editions.

John Joseph Conrad Keppleman, one of the best known of the foundrymen in Reading, Pa., died April 27, aged 80 years. He located in Reading in 1850 and established a foundry. With H. Crecelius and Christian Stoltz he conducted the Union Foundry on the site of the present Carpenter Steel Works. He retired 20 years ago. He was a native of Karlsruhe, Baden.

GENERAL INDUSTRIAL NOTES

The United States Radiator Co., Dunkirk, N. Y., has increased its capital stock from $200,000 to $300,000, the additional $100,000 having been subscribed for by the old stockholders. This was necessary to take care of the extension of the company's business. Ground has been purchased for another plant, but no plans have yet been made for its erection.

The firm of Mayer Bros., founders and machinists, Mankato, Minn., has been succeeded by the Mayer-Hacker Mfg. Co., which was recently reorganized with a capital of $200,000. Carl F. Hacker is president; Louis Mayer, vice president; Lorenz I. Mayer, secretary and treasurer.

The plant of the Gadsden Pipe & Foundry Co., Gadsden, Ala., has been sold to H. Hammond and associates, who have organized the Gadsden Pipe & Fittings Co. to operate the plant. The new company's offices are in the Brown-Marx building, Birmingham, Ala.

The West Steel & Iron Castings Co., Cleveland, which started its new plant some months ago, has increased its capital stock from $30,000 to $60,000. No extensions are planned at present.

The Buffalo Crucible Casting Co., Buffalo, has recently increased its facilities and is now in position to make prompt deliveries and can commence molding on receipt of patterns. The company makes high grade crucible steel castings from 1 to 1,000 pounds, which are particularly adapted for use as automobile parts and for other machinery where high tensile strength and long wearing qualities are desired.

Joseph Body and Samuel H. Baird announce that they have formed a copartnership, under the firm name of Body, Baird & Co., to deal in pig iron, steel, scrap, coal, coke and iron ores, with offices in the Pennsylvania building, Fifteenth and Chestnut streets, Philadelphia.

John J. Caine, Philadelphia, iron and steel scrap merchant, previously located in the Real Estate Trust building, has removed to 1413-1416 North American building.

The Hastings Foundry & Iron Works, Hastings, Neb., has been incorporated with a capital of $30,000, by A. L. Clarke, C. B. Hutton, C. G. Wallace, George Wilkes and A. H. Farrens.

The Peoria Malleable Iron Works, Peoria, Ill., has been incorporated to manufacture machinery tools and implements. The capital stock of the company is $75,000, and the incorporators are: George T. Page, C. E. McNemar and John C. Scully.

The Ironton Malleable Co., Ironton, O., has been organized with a capital of $150,000, by H. A. Martin, D. C. Davies, F. J. Ginn, E. O. Marting and F. J. Gilbert.

The Van Meter Foundry Co., Reading, Pa., has been organized with a capital of $25,000, by Joseph W. Van Meter, Norristown; William J. Ogden, Philadelphia; and Edward F. Stratton, Royersford.

The Patent Sad Iron Mfg. Co., East Orange, N. J., has been chartered with a capital of $100,000 by Charles O. Geyer, Frank S. Ferguson and Augustus W. Condit, all of East Orange.

The Scottdale, Pa., plant of the United States Cast Iron Pipe & Foundry Co., has recently added four No. 84 Newten patent cupolas to the melting equipment of its pipe foundry. This has increased the melting capacity to six cupolas of this type. Each furnace has a stack approximately 57 feet high and an average capacity of about 16 tons per hour, giving approximately 96 tons hourly capacity. These cupolas were manufactured and furnished by the Northern Engineering Works, Detroit, Mich.

The Hagan Gas Engine & Mfg. Co., Winchester, Ky., reports that there is a good opening in its vicinity for a gray iron foundry, as a large number of castings are used in that center and there is no foundry within 100 miles of the place. Those desiring further information can secure the same by writing this concern.

The new foundry of the American Hoist & Derrick Co., St. Paul, Minn., will be heated by a blower system, which will be installed by the B. F. Sturtevant Co., Hyde Park, Mass.

The Wales Foundry & Mfg. Co., New Brunswick, N. J., has been organized with a capital of $50,000 by Charles T. Wales, Henry H. Janeway and A. C. Streitworf, all of New Brunswick.

The Reliance Steel Foundry Co., Trenton, N. J., has been formed with a capital of $150,000 by Cornelius Valentine, Short Hills, N. J.; Charles P. Watson, New York; and C. Henry Stauffer, Philadelphia.

The New England Foundry Co., Buckfield, Me., has been organized with a capital of $10,000 by H. B. Hayden, R. F. Drew, Buckfield, Me.; and C. H. Hersey, Flemington, N. Y.

The Shelbyville Foundry & Machine Works, Shelbyville, Ind., has been incorporated with a capital stock of $50,000 to manufacture gasoline engines. The officers of the company are: Samuel J. Myers, president; William Fretchling, vice president; Franklin E. Irwin, secretary, and Wilbur W. Israel, treasurer.

Articles of incorporation have been filed by the Moore Foundry Co., Smithfield, Fayette county, Pa., with a capital of $5,000. The incorporators are: E. Dalefield, D. H. Baer, J. D. Moore, G. A. Moore and J. T. King.

The American Foundry & Castings Co., Dayton, O., has been incorporated with a capital of $10,000. The incorporators are: William J. Rosencrans, John T. Dietz, James J. Kilcoyne, Oscar F. Davison and Ellis J. Finke.

The Osborn Foundry Co., Detroit, has been incorporated with a capital of $10,000. The incorporators are: Harry G. Osburn, Detroit, and Joe C. Osburn and Alfred G. Laubengayer, both of Owosso, Mich.

The North Star Foundry Co., Spokane, Wash., has been formed by E. A. Nordeen and Alfred Bjork, former employes of the Union Iron Works, of Spokane. They have leased the Barnard Mfg. Co.'s plant and will do jobbing work in brass and iron castings.

The Hercules Pipe Works, Anniston, Ala., which was purchased by the Union Foundry Co., from H. C. Weedon, of Boston, is now in operation.

The Westerville Foundry & Machine Co., Columbus, O., has been incorporated with a capital of $10,000. The incorporators are. V. A. Taylor, W. B. Cockrell, Charles S. Keeney, John Morissey and F. B. Mulligan.

Foster Bros. Mfg. Co., St. Louis, manufacturer of iron beds, has just erected a new foundry and is planning to build a large plant in the vicinity of Second and Buchanan streets.

The Hartford Foundry Co., Hartford, Conn., which has been in the hands of Charles E. Dustin, receiver, since Dec. 13, 1905, has been reorganized, with $100,000 additional capital stock.

Brass Works.

The James Morrison Brass Mfg. Co., Toronto, Can., will rebuild its brass foundry which was recently damaged by fire, with four stories additional to provide for increasing business. Orders for immediate requirements in foundry equipment have been placed.

The Stuttle Brass Mfg. Co., Batavia, Ill., maker of brass, bronze, and aluminum castings, has incorporated with a capital of $2,500 and has taken over the business heretofore conducted by Henry Stuttle. The company occupies a new factory building recently completed. Henry Stuttle is president and Carl O. Klingholz secretary and treasurer.

The Eagle Brass Foundry Co., Seattle, Wash., has been organized with a capital of $10,000, by Alexander G. Howat, William Anderson and John Tracy.

The Standard Brass Foundry Co., Cleveland, has been incorporated with a capital of $10,000. The incorporators are: A. F. Hills, J. H. VanDerveer, George Doughty, F. Pfaffman, and John P. White.

The Michigan Copper & Brass Co., Detroit, will increase its capital stock from $400,000 to $600,000. Its large plant is now practically completed and will soon be placed in operation.

The Pilling Brass Co., Waterbury, Conn., has been organized with a capital of $25,000, and will make a specialty of rolling brass for use on automobile radiators, harness trimmings, etc. The plant of the old Waterbury Malleable Iron Co. has been leased and put in operation. John W. Pilling is president and treasurer, and J. L. Sweiger, secretary.

The E. A. Stege Mfg. Co., Louisville, Ky., has been incorporated with a capital of $15,000, and will do metal plating, brass founding and polishing. The incorporators are: George Stege, Louis Stege, C. Stege, Edward Gramemeyer, John Wendhorst and Sam Stege.

New Construction.

The Superior Foundry Co., Cleveland, at present employing about 600 hands, and doing an extensive business in the manufacture of piano plates and jobbing work, melting about 85 tons daily, is about to erect an extensive addition to its plant, which will double the capacity of the piano plate department, at present 250 plates per day. The buildings to be erected comprise a foundry 176 x 190 feet, a trimming room 146 x 55 feet, and a fireproof storage vault 26 x 48 feet. An 84-inch Whiting cupola will be installed in the foundry. The buildings will be of steel and concrete construction, with monitor roofs, and will be erected at the rear of the present plant at E. Seventy-first street and the Wheeling & Lake Erie railroad. The addition was designed by Raymer T. Hanford, constructing engineer, Sharon, Pa.

The Allegheny Valley Malleable Iron Co., New Kensington, Pa., is erecting a malleable plant on a site of 14 acres, which will contain two 15-ton furnaces, and in which operations will be commenced about Sept. 1. From present indications the output of the plant will be doubled early next spring. A. W. Phelps, formerly manager of the St. Louis Malleable Casting Co., St. Louis, is manager of the new foundry.

The Valley Gray Iron Foundry Co., Saginaw, Mich., recently incorporated with a capital stock of $20,000, is erecting a plant, the main building of which is to be 60 x 126 feet, and which will be equipped with modern machinery operated by electric power. The company has a large contract for machinery castings and expects to commence operations about July 1. The officers and directors are Alexander G. Finlay, president and general manager; John Luetjohn, vice president; Peter J. Redmond, secretary; William P. Powell, treasurer, and E. C. Mershon.

The Ellwood Malleable Co. has been organized under the laws of Delaware, with a capital of $250,000, and will erect two large foundries at Sharon, Pa. The incorporators are Frank C. Dambaugh, Henry J. Hendricks, and W. J. McKean, of Ellwood, and Ira W. Logan, of Rochester, Pa.

The Lonsdale Foundry Co., Lonsdale, Tenn., organized some six months ago by John T. Ammons, Arthur Richards and others, will erect a two-story addition, 30 x 136 feet.

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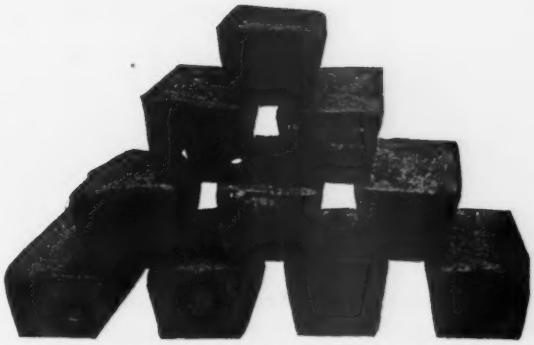
The Beauty of a Brass Casting

is greatly enhanced by its finish



My **WHITE COLUMBIA COLORING** ("White Rouge") gives most effective service in finishing brass castings, nickel plate stove trimmings, and any plated castings where a high finish is required.

On ornamental castings showing projections or impressions it is especially effective; all remaining particles are easily washed out.

EMERY GLUE

There are glues and glues, at all prices. The kind that sticks and stays is the kind I sell. I don't make it, but it is made for me by a glue factory that is pretty careful to keep up the standard, and its use means a saving in factory expense.

It won't cost you anything to prove this, if you will try a sample.

I manufacture a complete line of **Polishing** and **Plating Compositions.** In addition to the things I manufacture I carry a warehouse stock of everything required in a polishing and plating room, which includes **Spanish Felt Wheels, Mexican Felt Wheels, Canvas Wheels, Bull Neck Wheels,** and all the multitudinous articles required.

I also do a very respectable business in the manufacture of **Foundry Facings** and **Supplies.** In short, I operate two factories, and can give you good service at any time.

Frederic B. Stevens

Manufacturer Foundry Facings, Polishers' and Platers' Supplies.

Corner Larned and Third Sts., - - DETROIT, MICH.

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CLASSIFIED

BUYERS' DIRECTORY

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Abrasive Materials:
Carborundum Company, Niagara Falls.
Cortland Corundum Wheel Co., Cortland, N. Y.
Monarch Emery-Corundum Wheel Co., The, Camden, N. J.
Norton Company, Worcester, Mass.

Accountants:
Library Bureau, Systematizing Dept., Boston.

Air Compressors:
American Air Compressor Works, New York.
Chicago Pneumatic Tool Co., Chicago.
Curtis & Co. Mfg. Co., St. Louis.
Independent Pneumatic Tool Co., Chicago and New York.
Norwalk Iron Works Co., So. Norwalk, Conn.

Alloys:
Blackwell, Geo., Sons & Co., Ltd. Liverpool, Eng.
New Era Mfg. Co., Kalamazoo, Mich.
Phosphor Bronze Smelting Co., Ltd. Philadelphia.

Analysis—Mechanical:
Keep, W. J., Detroit.

Analysis—Chemical:
Detroit Testing Laboratory, Detroit
Engineers & Founders Laboratories, Pittsburg.
Metallurgical Laboratory, Pittsburg.

Anchors:
Lindsay, W. W. & Co., Philadelphia.

Babbitt Metal:
Ajax Metal Co., Birmingham, Ala.
New Era Mfg. Co., Kalamazoo, Mich.

Black Lead:
United States Graphite Co., Philadelphia.
United States Graphite Co., The, Saginaw.

Blowers:
American Blower Co., Detroit.
Connersville Blower Co., Connersville, Ind.
Cornell, J. B. & J. M. Co., New York.
Electric Blower Co., Newton Centre, Mass.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson, J. W. Co., Philadelphia.
Piqua Blower Co., Piqua, O.
Roots, P. H. & F. M. Company, Connersville, Ind.
Sturtevant, B. F. Co., Hyde Park, Mass.

Blowers—Positive Pressure:
Connersville Blower Co., Connersville, Ind.
Piqua Blower Co., Piqua, O.
Roots, P. H. & F. M. Company, Connersville, Ind.
Sturtevant, B. F. Co., Hyde Park, Mass.
Wilbraham-Green Blower Co., Philadelphia.

Brakes (Electric):
Electric Controller & Supply Co., Cleveland.

Brushes:
American Wire Brush Co., New York.
Osborn Mfg. Co., Cleveland.

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Lindsay, W. W. & Co., Philadelphia.

Burners (Oil):
Monarch Engineering & Mfg. Co., Baltimore.

Carbonese:
Midvale Mining & Mfg. Co., E. St. Louis, Ill.

Castings (Steel):
Otis Steel Co., Ltd., Cleveland.

Cement (Furnace):
Gautier, J. H. & Co., Jersey City.
Dixon Crucible Co., Jos., Jersey City.

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GALVARIM RIDDLES

Galvarim—an abbreviated or coined word, synonymous of a metal rim—galvanized. The rim opens up, allowing for the insertion of any mesh bottom in the groove provided for same. Rim turned top and bottom over $\frac{3}{16}$ in. rod—likewise the wire cloth.

Saves you 40% of your cost in a year's time.

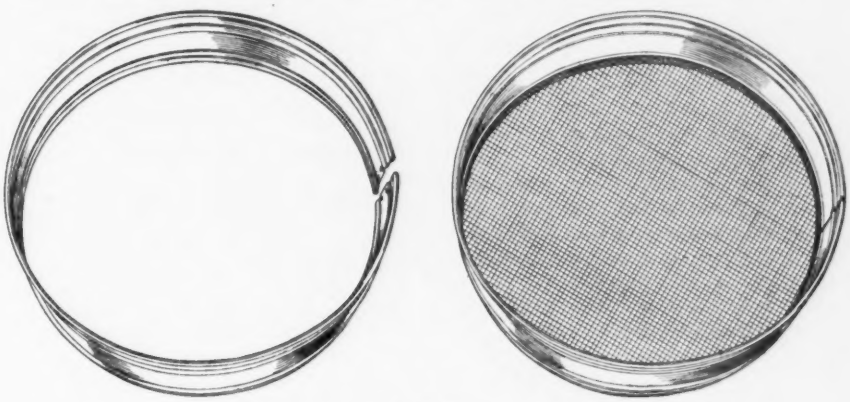

Fig. 36

THE OLD STYLE.	GALVARIM.
The old rim splits.	Ours does not.
If you wear a hole in the mesh the the efficiency is gone.	Put in a new bottom.
If it gets gummed up in the core room—they throw it away.	Place ours on the stove, boiler, or in core oven and burn the gum off.
Competition forces the use of cheap wire.	Not having competition we can afford to give you the best.

You do not have to carry a stock of riddles when you use the Galvarim,—one rim for each molder is sufficient. Carry a stock of bottoms—takes little room in the stock-room, and costs less than complete wood rimmed.

Price, complete, 3 dozen lots, - -	$6.00 per doz.
Less than 3 dozen lots, - - - -	7.20 per doz.
Bottoms, less than 3 dozen lots, - -	3.50 per doz.
Bottoms, 3 dozen lots - - - -	3.00 per doz.

The Detroit Foundry Supply Company.

Facing Mills—
Detroit, Mich.

Facing
Fire Brick
Foundry Supplies
Foundry Equipment

Warehouses—
Detroit, Mich.
Windsor, Ont.

Cement (Metallic):

Clark Cast Steel Cement Co., Shelton, Conn.
Shanafelt Mfg. Co., Canton, O.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.

Chaplets:

Burdick & Son, Albany, N. Y.
Lindsay, W. W. & Co., Philadelphia.
Shanafelt Mfg. Co., Canton, O.

Clamps:

Batavia Clamp Co., Batavia, N. Y.
Thompson, A. M., Chicago.

Coke:

Camden Coke Co., Camden, N. J.
Dimmick, J. K. & Co., Philadelphia.
Elliott, Debevoise & Anderson, New York.
Rogers, Brown & Co., Cincinnati.

Controllers (Electric):

Electric Controller & Supply Co., Cleveland.

Conveyors:

Link-Belt Co., Philadelphia, Pa.

Cores:

Brown Specialty Machry. Co., Chicago.

Core Binders:

Holland Linseed Oil Co., Chicago.
Mills, C. E., Oil Co., Syracuse.
National Jeloluse Co., New York.
Robeson Process Co., Camden, N. J.
Sterling Oil Co., Emlenton, Pa.
Young, Frank L., & Kimball, Boston.

Core Compounds:

Young, Frank L., & Kimball, Boston.

Core Machines:

Brown Specialty Machry. Co., Chicago.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Jones & Atwood, Stourbridge, Eng.

Core Ovens:

Atlas Car & Mfg. Co., Cleveland.
Falls Rivet & Mch. Co., Cuyahoga Falls, O.
Hill & Griffith Co., Cincinnati.
Millett Core Oven Co., Brightwood, Mass.
Pangborn, Thos. W. Co., New York.
Paxson, J. W. Co., Philadelphia.
Roberts Portable Oven Co., Chicago.
Smith, J. D., Foundry Supply Co., Cleveland.

Core Oven Recording Thermometer:

Bristol Co., Waterbury.

Core Tapering Machines:

Brown Specialty-Machinery Co., Chicago.

Cost Keeping Systems.

Library Bureau, Systematizing Dept., Boston.
Loughry, James C., Elyria, O.
Stradley & Co., Edward M., Philadelphia.

Cranes:

Brown Hoisting Machine Co., The, Cleveland.
Case Mfg. Co., Columbus, O.
Curtis & Co. Mfg. Co., St. Louis, Ill.
General Pneumatic Tool Co., Montour Falls, N. Y.
Manning, Maxwell & Moore, New York.
Maris Bros., Philadelphia.
New England Eng. & Equipment Co., Boston.
Niles-Bement-Pond Co., New York.
Northern Engrng. Works, Detroit.
Pawling & Harnischfeger, Milwaukee.
Ridgway, Craig, & Son, Coatesville, Pa.
Sellers, William & Co., Inc., Philadelphia.
Whiting Foundry & Equipment Co., Harvey, Ill.

Crucibles:

Dixon Crucible Co., Jos., Jersey City.
Gautier, J. H. & Co., Jersey City.
McCullough-Dalzell Crucible Co., Pittsburg.
Monarch Engineering & Mfg. Co., Baltimore.
Paxson, J. W. Co., Philadelphia.
Ross-Tacony Crucible Co., Philadelphia.
Seidel, R. B., Inc., Philadelphia, Pa.
Taylor, A. L., San Francisco.
Taylor, Robt. J., Inc., Philadelphia.

Cupolas:

Byram & Co., Detroit.
Detroit Foundry Supply Co., Detroit.
Etting, Edward J., Philadelphia.
Gilmour, J., New York.
McCormick, J. S. Co., Pittsburg.
Northern Engrng Works, Detroit.
Paxson, J. W. Co., Philadelphia.
Whiting Foundry Equipment Co., Harvey, Ill.
Wonham & Magor, New York.

Cupola Linings:

Laclede Fire Brick Mfg. Co., St. Louis.
McCormick, J. S. Co., Pittsburg.
Paxson, J. W. Co., Philadelphia

Drawings for Malleable Melting Furnace:

Buffalo Furnace Works, Buffalo.

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Independent Pneumatic Tool Co., Chicago and New York.

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Sturtevant B. F. Co., Hyde Park, Mass.

Elevators:

Chicago Pneumatic Tool Co., Chicago.
Curtis & Co., Mfg. Co., St. Louis.
Ridgway, Craig, & Son, Coatesville, Pa.

Engines (Steam):

American Blower Co., Detroit.
Sturtevant, B. F. Co., Hyde Park Mass.

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The Cost of It

The expense of a modern system of cost-keeping need be no greater than a crude, antiquated and inefficient way of keeping accounts.

Such a system is accurate, quick and in ample detail, and it gives the detailed costs of every part of the work while the business is fresh—when it is most valuable as a basis of comparison.

We have studied cost-keeping very carefully and have installed systems which meet these requirements in many well-known foundries.

Will you accord us an interview?

GUNN, RICHARDS & COMPANY

Production Engineers and Public Accountants.....

43 WALL STREET, 43 EXCHANGE PLACE, } NEW YORK — 50 CONGRESS STREET, BOSTON

224 ST. JAMES STREET, MONTREAL

"THE ROOKERY" CHICAGO, ILL.

Engineers (Foundry, Mech., Elec., &c.):
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Hooper, Geo. K., New York City.
Lindsay, W. W. & Co., Philadelphia.

Exhausters (Gas):
Wilbraham-Green Blower Co., Philadelphia.

Facings:
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Detroit Foundry Supply Co., Detroit.
Dixon Crucible Co., Jos., Jersey City.
Doggett, Stanley, New York.
Hill & Griffith Co., Cincinnati.
MacKellar's, R. Sons Co., Peekskill, N. Y.
McCormick, J. S. Co., Pittsburg.
Obermayer, S. Co., Cincinnati.
Paxson, J. W. Co., Philadelphia.
Pettinos Bros., Bethlehem, Pa.
Smith, J. D., Foundry Supply Co., Cleveland.
Stephens & Co., Kidwelly, Eng.
Stevens, F. B., Detroit.
United States Graphite Co., The, Saginaw, Mich.
Vulcan Facing Co., Chester, Pa.
Western Foundry Supply Co., E. St. Louis, Ill.

Fans:
American Blower Co., Detroit.
Sturtevant, B. F. Co., Hyde Park, Mass.

Ferro-Chrome:
Western Foundry Supply Co., E. St. Louis, Ill.

Ferro-Manganese:
Kendall & Flick, Washington, D. C.
Primos Chemical Co., Primos, Pa.
Rogers, Brown & Co., Cincinnati.
Western Foundry Supply Co., E. St. Louis, Ill.

Ferro-Silicon:
Primos Chemical Co., Primos, Pa.
Roessler & Hasslacher Chemical Co., New York.
Rogers, Brown & Co., Cincinnati.
Western Foundry Supply Co., E. St. Louis, Ill.

Fillers (Metallic):
Clark Cast Steel Cement Co., Shelton, Conn.
Shanafelt Mfg. Co., Canton, O.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.

Fillets:
Cleveland Fillet Co., Cleveland, O.
Shanafelt Mfg. Co., Canton, O.

Fire Brick:
Borgner Co., Cyrus, Philadelphia.
Detroit Foundry Supply Co., Detroit.
Gautier, J. H. & Co., Jersey City.
Harbison & Walker, Pittsburg.
Maurer, Henry, & Son, New York.
Laclede Fire Brick Mfg. Co., St. Louis.
Paxson, J. W. Co., Philadelphia.
Wm. Penn, Silica Works, Wm. Penn, P. O., Philadelphia.

Fire Sand:
Carborundum Co., Niagara Falls, N. Y.

Flasks:
Adams Co., Dubuque, Ia
Barnett, Oscar, Fdy. Co., Newark.
Brass Founders' Supply Co., Newark.
Macphail Flask & Machine Co., Chicago.
Middleditch, Benj., Detroit.

Flasks (Snap):
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Diamond Clamp & Flask Co., Richmond, Ind.
Jurack Pattern & Fdry. Supply Mfg. Co., Chas., Milwaukee.
Obermayer, S. Co., Cincinnati.
Paxson, J. W. Co., Philadelphia.

Flour:
Piqua Flour Co., The, Piqua, O.
Millers' Product Co., The, Chicago.

Flux:
Basic Chemical Co., Evansville, Ind.

Foundry Equipment (Iron & Brass):
Barnett, Oscar, Foundry Co., Newark.
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Hay's Sons, Sam'l W., Pittsburgh.
Koppel Co., Arthur, Pittsburg, Pa.
Morton Mfg. Co., Muskegon Heights, Mich.
New England Eng. & Equipment Co., Boston.
Obermayer, S. Co., Cincinnati.
Pangborn, Thos. W. Co., New York.
Sly, W. W., Mfg. Co., Cleveland.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit.
Taylor, Robert J., Inc., Philadelphia.
Whitehead Bros. Co., Providence, R. I.
Wonham & Magor, New York.

Foundry Supplies:
Crivel & Co., Geo. F., Buffalo.
Detroit Foundry Supply Co., Detroit.
Hill & Griffith Co., Cincinnati.
McCormick, J. S. Co., Pittsburg.
Obermayer, S. Co., Cincinnati.
Osborn Mfg. Co., Cleveland.
Pangborn, Thos. W. Co., New York.
Paxson, J. W. Co., Philadelphia.
Shanafelt Mfg. Co, Canton O.
Smith, J. D., Foundry Supply Co., Cleveland.
Steel Preservation Co., Buffalo.
Stevens, F. B., Detroit.
Taylor, A. L., San Francisco.
Taylor, Robert J., Inc., Philadelphia.
Whitehead Bros. Co., Providence, R. I.

Furnaces (Melting):
Barnett, Oscar, Foundry Co., Newark, N. J.
Buffalo Furnace Works, Buffalo.
Fisher, Alfred, Chicago.
Hawley Down Draft Furnace Co., Chicago.
Monarch Engineering & Mfg. Co., Baltimore.
New England Eng. & Equipment Co., Boston.
Paxson, J. W. Co., Philadelphia.
Rockwell Engineering Co., New York.

Graphite:
United States Graphite Co., Philadelphia.
U. S. Graphite Co., The, Saginaw.

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